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Environmental Assessment

Middle River II

Houston/Rolla/Cedar Creek Ranger District, Mark Twain National Forest
Callaway County, Missouri



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CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Document Structure

The Forest Service is preparing this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment (EA) discloses the direct, indirect, and cumulative environmental effects that would result from the proposed action and alternatives. The document is organized into five chapters.

Chapter 1. Purpose and Need for Action: This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives Considered: This chapter provides a more detailed description of the agency's proposed actions as well as alternative methods for achieving the stated purpose. These alternatives were developed based on key issues raised by the public and other agencies. A summary table of the proposed projects associated with each alternative is provided.

Chapter 3. Environmental Effects: This chapter describes the existing conditions and the environmental effects of implementing the proposed actions and other alternatives.

Chapter 4. Additional Management Tools used to achieve DFC: This Chapter describes additional tools the Forest Service would use to achieve the Forest Plan Desired Future Condition.

Chapter 5. Project Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of the Environmental Assessment.

Appendices: The appendices would provide more detailed information to support the analyses presented in the Environmental Assessment.

Appendix A: References

Appendix B: Glossary

Appendix C: Biological Diversity

Appendix D: Economic Analysis Tables

Appendix E: Soil Characteristics Tables

Appendix F: Middle River Project Maps

Appendix G: Biological Evaluation and Assessment

Appendix H: Photographs of Invasive Plants, Herbicide Labels, MSDS

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Cedar Creek District Office in Fulton, Missouri.

Project Location, Setting and Background

The Middle River project area is located on Mark Twain National Forest (MTNF) lands administered by the Houston/Rolla/Cedar Creek Ranger District in Callaway County approximately seven miles southwest of Fulton, Missouri, east of Route BB and south of Highway 54. The legal description of the project area is the

lands within the purchase unit boundary in Township 46 North, Range 10 West, in parts of sections 13, 14, 24, 25 and 36 of the Fifth Principle Meridian. Refer to the vicinity map in Appendix F.

The project area consists of approximately 1300 National Forest acres of the Cedar Creek Unit in compartments 9 and 10. The Mark Twain National Forest Land and Resource Management Plan (MTNF-LRMP) identifies Management 3.4-9 as the sole Management Area for the Middle River Project.

Most of the lands on the Cedar Creek Unit were acquired during the 1940's under Title II of the Bankhead Jones Farm Tenant Act of 1937. Under the Act, the Soil Conservation Service, now known as the Natural Resources Conservation Service (NRCS), undertook a restoration program to correct years of land abuse due to overgrazing, cropping on unsuitable soils, and clearing of timber. Grazing was permitted on the land suitable for such use, and in 1951, the NRCS entered into a cooperative agreement with a group of farmers who organized as the Cedar Creek Grazing Association. The purpose of the agreement was to secure the cooperation of the farmers in maintaining the improvements, fertility of the land, and the productivity of the pastures.

In 1953, these lands were transferred to the US Forest Service for administration and management under the multiple use concept. In 1970, a classification study determined that the lands of the unit were suitable for National Forest purposes and that a larger land base was needed. In 1972, the area was designated as a Purchase Unit of the Clark National Forest. Since that time, the Unit has been managed as a District of what is now the Mark Twain National Forest. In 1992, the Cedar Creek Purchase Unit was granted National Forest status by Congress. Today this unit encompasses 16,500 acres of the 1.5 million acres of the Mark Twain National Forest in Missouri.

Management of the Mark Twain National Forest has included numerous activities designed to encourage the growth and development of the forest and to create a mix of forest types and ages as well as openlands that are favorable to a variety of wildlife species. Timber harvest, prescribed burning, use of livestock, and other methods of opening maintenance have been the primary methods used to achieve these objectives.

In the Middle River Project Area, various activities that have been conducted since National Forest ownership include firewood harvests, uneven-aged timber harvest in Compartment 10, tree planting in the riparian area, cedar harvests, erosion control improvements, conversion of fescue and hay fields to native warm season grasses, pond development and maintenance, livestock grazing, and some wildlife opening maintenance.

Forest Wide Direction and Goals

Forest-wide direction guides all natural resource management practices and established the management standards and guidelines for the Forest over the planning period. Management direction also includes the goals (LRMP, pages IV-1 to IV-4)) objectives (LRMP, pages IV-4 to IV-10), Forest-wide standards and guidelines (LRMP, pages IV-11 to IV-86), management area prescriptions with their specific standards and guidelines (LRMP, pages IV-87 to IV-234), and delineations of management areas.

The goals are concise statements describing a desired result to be achieved over the planning period, through implementing the Mark Twain National Forest LRMP. Multiple uses such as recreation, wildlife, timber, transportation, fire, soil, and water management goals all apply to the Middle River Project.

Desired Future Condition of Management Area

The Mark Twain National Forest LRMP allocated lands within the Middle River Project Area to Management Area 3.4. This allocation identified desired future conditions and gave general management direction for the management area found in the Middle River Project Area.

Management Prescription 3.4

Management Prescription 3.4 is described by the following (LRMP, pages IV-115 to IV-124): “Desired Future Forest Condition: Management areas will generally be 2,500 acres or larger. Management areas will provide a diverse natural appearing mosaic of stands. Various stages of vegetative communities’ development will be featured. Oaks will be the dominant species; however, a variety of other hardwoods will also be present, as will shortleaf pine, eastern redcedar and grassland. Individual stands will have irregular shapes and varying sizes. The trees within each stand will be about the same age and size. Stands will range from seedlings to large trees. Openings of various sizes will be interspersed among the tree stands.”

“Intensity of terrestrial and aquatic wildlife habitat management may vary with size of ownership, access, demand, and capability to respond to management activities. Interspersion of age and size classes of trees and openings will satisfy the habitat needs of management indicator species.”

“There may often be evidence of human activities, but it will be in harmony with the natural appearing environment. Interaction between users will be moderate.”

The purposes of this prescription, as stated on IV-115 of LRMP are:

1. To emphasize wildlife habitat diversity by maintaining and enhancing populations of native and naturalized vertebrates and the habitat for management indicator species.
2. To emphasize recreational opportunities based on consumptive and non-consumptive use of wildlife and fish.
3. To provide dispersed recreation opportunities featuring a roaded natural recreation environment.
4. To provide for moderate to high production of other resources such as timber products, recreation, forage, and minerals.
5. To satisfy the management requirements of 36 CFR 219.27.

Purpose and Need for Action

Preliminary analysis of the project area indicates that there are certain conditions that warrant actions to accomplish the direction and desired conditions identified in the Mark Twain Forest Plan. Specifically, the following needs for actions have been identified with approximate measures. These proposed actions were

identified to move the existing condition of the Middle River Project area towards the Desired Future Condition (DFC). The LRMP established various habitat condition objectives to maintain a wide variety of habitats (and the associated ecosystems with their ecosystem functions) that are commonly found in Missouri Ozark Border. The habitat condition (DFC) objectives for the Oak-Hickory Hills Land Type Associations (LTA) in Management Area 3.4-9 are found on LRMP page IV-120.

There are three emphasis areas in the LRMP that need to be addressed in the Middle River Project Area. They include:

- A. Wildlife Habitat Enhancement Needs
- B. Watershed Health Needs
- C. Recreation Management Needs

Note: There are also some associated or connected actions needed to implement these three emphasis areas in the Middle River Project.

A. Wildlife Habitat Enhancement Needs

Need A1. Provide Open and Semi-Open Habitats. (Desired Future Condition 10-20%)

Open and semi-open lands are important habitats for approximately 200 species. These areas provide vegetative composition and plant structure that differs from predominately forested environments. These habitats include both grazed and non-grazed fields composed of native warm season grasses and cool season grasses. The variety of grasses and forbs provide a diverse plant community. In order to work towards the Forest Plan desired habitat objectives, the amount of open and semi-open areas need to be reduced.

During analysis and review done in the 1980s', approximately 45% of Middle River Project Area consisted of open and semi-open areas. In that analysis it was decided to plant some areas to hardwoods and allow some open areas to revert to more woody structure. In the years since this analysis, open and semi-open habitat, with its mixture of grass, forbs, and wildflowers, has been reduced to 37 % of the area.

Need A2: Provide Woodland Habitat in Old Growth Condition. (Desired Future Condition 10-15%)

Currently there are 83 acres or 6 % of the Middle River Project Area that had been designated as old growth through a decision notice on the Dixie Vegetation Projects in 1993. Old growth habitats are used by approximately 87 terrestrial species (9 amphibians, 11 reptiles, 11 mammals, and 56 birds (including neotropical migrant birds). In order to meet Forest Plan habitat objectives in this habitat type, this area needs 104 acres but should not exceed 194 acres.

Need A3: Provide 40-50 percent of the sawtimber component of the Woodland Habitat in Oak, Oak-Pine, and Pine exhibiting a condition of 20-30 percent forbs, grass and shrub ground cover. (Desired Future Condition 40-50% of sawtimber)

Currently there are 186 acres or 14% of this habitat in the Middle River Project Area. Woodland habitats in oak, oak-pine, and pine forest types with 20% to 30% forbs, grass, and shrub ground cover are important habitat types for wildlife. Over 60 animal species are associated with this habitat type

including 4 amphibians, 4 reptiles, 30 birds (including neotropical migrant birds), and 25 mammals. In order to meet Forest Plan habitat objectives in this habitat type, this area needs at least 518 acres but should not exceed 648 acres.

Need A4: Provide Woodland Habitat in the 0-9 year age class. (Desired Future Condition 8-15%)

Currently there are 16 acres or 1% of 0-9 year age class habitat in the Middle River Project Area. Species richness in woodland habitats in the 0-9 year age class ranges from 40 to 49 animal species, but the edges of these habitats are used by 90 species that include 3 amphibians, 14 reptiles, 23 mammals, and 50 birds (including neotropical migrant birds). In order to meet Forest Plan habitat objectives in this habitat type, this area needs at least 52 acres.

Need A5: Provide Diverse Amphibian Habitat. (LRMP, page IV-120)

Currently there are 10 ponds in the Middle River Project Area. Fishless ponds and temporary pools provide habitat for 11 amphibians. Three of the ponds do not contain fish in the project area. In order to meet Forest Plan habitat objectives, this area needs no more than 8 fishless ponds to provide this habitat.

B. Watershed Health Needs

Need B: Improve Overall Watershed Health in Middle River Project Area (LRMP, pages IV-45, IV-47, IV-52, and IV-55).

There are several areas that are reducing the Middle River Project Area's riparian quality, the existing water quality and will continue to be concerns in the future. In order to meet Forest Plan Standards and Guides, these watershed concerns need to be addressed. In addition, there is Forest Plan direction to close unnecessary and/or unauthorized roads (FP IV-3).

C. Recreation Management Needs

Need C: Recreation Management (LRMP provides guidelines for recreation and cultural resource management (FP IV-2).

The Middle River Project Area is utilized for dispersed recreation including hunting, horseback riding, hiking, fishing, and wildlife viewing. There are currently 5 small graveled parking areas to access the area, with four of them fenced and gated. Walk-in access is provided at three of these parking areas. Improvements needed include gravel to enhance parking and enhanced access into the area with self-closing gates. There is also a known historic site in the area that has a high potential for interpretation. Interpretive signing of the site would provide Forest visitors an opportunity to learn more about local cultural history.

D. Associated or Connected Actions Needs

Need D: Some actions require other actions in order to be accomplished such as fireline construction, tree planting, site preparation and non-native, noxious weed control. Associated and connected actions will be considered in the environmental analysis of this project.

Proposed Actions

The following proposed actions were identified to move the existing condition of the Middle River Project Area towards the Desired Future Condition for wildlife habitat in the Oak Hickory Hills Land Type Association as outlined in the Mark Twain National Forest LRMP. All of the Proposed Actions below are letter and number coordinated to match the Need Statements described in the previous section of this document.

The following management actions listed in the document have been identified and are given with approximate measures. In addition, several management actions may occur over the same acres. See Appendix F for maps or Tables 4, 5 and 6 for compartment and stand treatment listings.

A. Wildlife Habitat Enhancement Actions:

To Enhance Wildlife Habitat in Middle River Project Area the proposal has 5 parts.

1. Provide Open/Semi-Open Habitat.

Proposed Action A1a: Provide existing open/semi-open habitat and native ecosystems on 400 acres. These 400 acres would move the area towards the DFC range outlined in the LRMP. This would be accomplished through prescribed burning and/or grazing, and mechanical treatments in both warm season and cool season grasses. Seeding and fertilizing to maintain these open grazed areas would also continue as needed.

Proposed Action A1b: Plant hardwoods on approximately 45 acres of openlands and allow 30 acres to naturally regenerate to native woodlands by reducing prescribed burning. This proposal would reduce the present amount of open/semi-open habitat and move the project area towards the desired future condition.

2. Provide Woodland Habitat in Old Growth Conditions.

Proposed Action A2: To move this habitat towards the DFC for the project area the proposal is to designate an additional 107 acres of old growth in the Middle River project area. These additional acres with those already designated (83 acres) include a variety of forest types, and block sizes to provide diversity of old growth forest conditions now and in the future. These proposed acres would place the area in the 10-15% range DFC outlined in the LRMP.

3. Provide 40-50 percent of the sawtimber component of the Woodland Habitat in Oak, Oak-Pine, and Pine exhibiting a condition of 20-30 percent forbs, grass and shrub ground cover.

Proposed Action A3a: To move this habitat towards the DFC for the project area, the proposal is to create approximately 460 acres of 20% to 30% ground cover with forbs, grasses, and shrubs habitat. This would be accomplished with the uneven-aged management (UEAM) technique of individual and group selection harvest in both hardwood and cedar stands. These acres would result in 36% of the Middle River Project Area in the 20 to 30% ground cover by forbs, grasses, and shrubs habitat condition.

Proposed Action A3b: Prescribed burning within 250 acres of woodlands will also contribute to this habitat type.

4. Provide Woodland Habitat in the 0-9 Year Age Class.

Proposed Action A4: To move this habitat towards the DFC for the project area, the proposal would create 69 acres (15% of the total area treated through group selection harvest) of 0-9 age class habitat. This would place the area in the 6% range and moving towards the DFC of 8-15%. (See Action A3a)

5. Provide Diverse Amphibian Habitat.

Proposed Action A5: To help move this habitat toward the DFC and improve amphibian habitat, the proposal is to breach and lower one pond in the project area.

B. Watershed Health Actions:

To Improve Overall Watershed Health in Middle River Project Area the proposal has 8 parts.

1. Fencing to Exclude Livestock.

Proposed Action B1: Currently livestock have access to several wooded areas. Restrict livestock from steeper eroded areas and drainages with fencing.

2. Pond Reconstruction.

Proposed Action B2: Presently one pond is accessible to livestock and therefore does not provide a quality watering source for either cattle or wildlife. Reconstruct this pond in the project area, which would include associated fencing and a cattle watering tank.

3. Reconstruct Existing Forest Road.

Proposed Action B3: Reconstruct Forest Road 1686 (0.9 mile) to improve the present drainage crossing and reduce soil movement. The original scoped proposal stated 0.4 mile, but the actual length of the road is 0.9 mile.

4. Improve Pasture Access.

Proposed Action B4: Improve access through the pastures and protect the soil resources with spot gravel in low or muddy areas in 4 locations.

5. Road Closure.

Proposed Action B5: Close approximately 0.4 miles of non-system and/or unauthorized roads through the use of boulders and/or gates.

6. Planting/Watershed Control Structure.

Proposed Action B6: Reduce soil movement at three wooded draws by planting and/or seeding native vegetation or installing a watershed control structure.

7. Well Closures.

Proposed Action B7: Close 2 existing open wells to improve safety to area users and protect soil resources.

8. Pond Maintenance.

Proposed Action B8: Maintain existing ponds as needed with methods such as mowing pond banks to control vegetation, fencing, or replacement of livestock watering tanks.

C. Recreation Management Actions

To Improve Overall Recreation Experience in Middle River Project Area the proposal has 3 parts.

1. Improve parking lots.

Proposed Action C1: Improve five parking lots with gravel.

2. Interpretive signing

Proposed Action C2: Construct interpretive signs for the cultural history.

3. Self-closing gate

Proposed Action C3: Improve dispersed access by installing a self-closing gate.

D. Associated or Connected Actions

Proposed Action D1. Some prescribed burn areas may need fireline construction. Natural firebreaks will be utilized wherever necessary. Construct approximately 1 mile of mechanical firelines.

Proposed Action D2. Reduce the spread and infestation of non-native invasive and noxious weeds such as multi-flora rose and/or sericea lespedeza (*Lespedeza cuneata*). Spot treat individual invasive plants with herbicide on 59 acres. *(Note: the individual plants would be treated by spot application only. Aerial application would not be utilized)*

Proposed Action D3. Improve hardwood seedling survival. Where hardwood plantings are proposed (See Proposed Action A1b), there is a need to improve seedling survival. Previous hardwood plantings into grasses such as fescue have greatly reduced survival and growth of planted trees. Spot treat seedling planting sites with herbicide within 45 acres to improve the seedling survival rate. *(Note: individual planting sites would be treated by hand application only.)*

Decision Framework

The District Ranger of the Houston/Rolla/Cedar Creek District of the Mark Twain National Forest, John Bisbee, is the Responsible Official for making project-level decisions from the Middle River Project Analysis.

Decision-making from the Middle River Project analysis is limited to National Forest System lands within the project area and associated areas of connected actions. Decision-making will be based on information in the Middle River environmental document and supporting record, including consideration of all public comments. Decision-making will be limited to specific activities relating to the 'Proposed Actions' as presented in the 'Purpose of and Need for Action'. No decisions will be made for actions that are not responsive to the expressed 'Purpose of and Need for Action'.

The decision to be made from the Middle River Project will be whether to implement the 'Proposed Actions', an action alternative that responds to the 'Purpose of and Need for Action', or, to select the no action alternative. If the 'Proposed Actions' or an action alternative is selected for implementation, the decision may include minor modifications as appropriate or necessary. Documentation and rationale of included modifications would be made in the decision document. If the no action alternative is selected for implementation, the Responsible Official may either discontinue the planning effort or document the decision in a decision document.

Public Involvement

A scoping letter with maps and project description was mailed to the district mailing list and adjacent neighbors on January 25, 2003 (97 addresses) to invite comments on the project. This project has also appeared in the forest-wide Schedule of Proposed Actions (SOPA). Comments received after the scoping period were accepted and evaluated in the development of issues and alternatives to the proposed action. The District received 8 responses to the scoping document. All comments received were reviewed and evaluated by the Interdisciplinary Team (IDT).

Several field visits with interested parties were conducted by members of the IDT. These tours included a site visit with a wildlife biologist from the Missouri Department of Conservation, who then provided comments during the scoping period. A tour with a representative from Mark Twain Forest Watchers was also conducted after the close of the scoping period. This individual looked at a variety of proposed projects including the open lands habitat management as well as the wildlife habitat management. He visited the site other times and provided comments at scoping, additionally after the scoping period had closed, as well as during the August comment period. A tour after the scoping period closed was conducted with several members of the Sierra Club to discuss the project proposals. A comment letter from the Sierra Club was received following this tour during the August comment period.

The purpose of soliciting comments during the scoping period is to determine whether there are any new or unresolved issues which affect a proposed action. Many issues and concerns originating from public responses and internal agency concerns are identified for analysis. Issues identified from comments during public scoping, from the Interdisciplinary Team, and from comments received from individuals following field visits were used to develop proposed alternatives. On August 6, 2003, a letter with a proposal for the Middle River Project was mailed to everyone on the district mailing list and adjacent neighbors to invite timely, substantive comments on the proposed projects as permitted by our revised regulations for notice, comment, and appeal (36 CFR 215). Legal Notice of this 30-day comment period was published August 12, 2003 in the *Fulton Sun*, Fulton, Missouri. Twelve comments were received, with nine of them timely. These comments were incorporated into this document in the Issues Section below. A listing of the comments can be found in the project file.

An EA was prepared and a decision notice was signed on February 18, 2004. On April 23, 2004, Ranger John Bisbee decided to withdraw the Middle River decision in order to clarify documentation on some key points in the project records and decision notice. This action resulted in this Environmental Assessment which is titled Middle River II.

Issues

The Interdisciplinary Team separated the issues into two groups: key issues and non-key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Non-key issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Section 1501.7 "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)..."

Issues Used to Develop Alternatives Studied in Detail:

Using the responses from the public, other agencies and organizations, the interdisciplinary team developed a list of key issues to address. Twelve responses were received, with nine of them timely, during the 30-day comment period in August 2003. Below is a brief synopsis of these nine public responses:

- Five of the nine responses supported the proposed Alternative 3 (four of these also proposed the addition of stand 27 in Compartment 9 to old growth habitat)
- One of the nine responses opposed the Middle River Project.
- One of the nine responses had multiple comments, but the substantive comment specific to this project was: "include in the Middle River EA descriptions and analysis of the adjacent properties and how this relates to the status and management of the lands in the Middle River Project from biological, recreational, and esthetic points of view." (complete letter in project record)
- One of the nine responses questioned the feasibility of managing open/semi-open areas for grazing purposes.
- Six responses support the distribution of openlands in Alternative 3.

The project file contains more details related to these comments.

Comments received during this 30-day comment period were used to refine the alternatives. These comments were incorporated into the analysis and were summarized into the following key issues:

Issue #1: Openlands Management:

Openlands habitat maintenance is a significant portion of the Middle River Project Area. The Middle River Project Area is located at the very northern edge of the Oak Hickory Hills LTA, and just below Oak Bluestem Plains LTA. Reducing the amount of openlands available for grazing to work towards the Forest Plan Wildlife Habitat Guidelines has been proposed. However, there were some comments related to leaving existing openlands available for openland habitat management and grazing.

Measure: Acres in open/semi-open habitat.

Issue #2: Old Growth Habitat

Some respondents felt that more or different areas (compared to the Proposed Action) should be designated as old growth to protect steeper drainages, protect the aesthetic qualities of the area, and provide more of this habitat type.

Measure: Acres in old growth habitat.

Issues That Have Already Been Addressed at a Higher Level or Issues That Can Be Resolved by Applying Mark Twain National Forest – Land and Resource Management Plan Standards and Guidelines.

Indiana Bat and Other Threatened, Endangered, Proposed, and Sensitive Species.

The Forest Service is responsible to protect all threatened, endangered, proposed, and Regionally sensitive species during project implementation. Standards and guidelines developed in consultation with the Fish and Wildlife Service during formal consultation and were subsequently incorporated into the programmatic LRMP. The Biological Assessment and Evaluation in Appendix G of this document consider the effects to covered species from the proposed activities.

Management Indicator Species

Management Indicator Species (MIS) were selected for the Mark Twain National Forest during forest planning in accordance with CFR 219.19. MIS are representative for estimating the effects of forest management on populations of other species. MIS for the Oak Hickory Hills are: pileated woodpecker, ovenbird, turkey, white-tailed deer, raccoon, bobwhite quail, orchard oriole, wood thrush, ruffed grouse, bobcat, indigo bunting, eastern bluebird, and cottontail rabbit (LRMP IV-48). The effects of the proposed actions and alternatives on MIS are addressed in this EA. Habitat objectives indicative of minimum viable populations of MIS are shown on page IV-62 of the LRMP.

Other Comments: A comment related to effects of the proposed projects, including effects to adjacent properties, was not developed into an issue for further discussion. The environmental effects, including cumulative effects, from the proposed alternatives as related to adjacent properties and to various resources within National Forest ownership are addressed in Chapter 3.

Relationship to Other Documents

A number of National Environmental Policy Act (NEPA) decisions have been made since June, 1986 (the date in which the LRMP went into effect), which affected all or part of the Analysis Area. Some documents provided for site-specific implementation of the forest plan and some of the documents provided broader programmatic direction.

Site-Specific Projects

Management Area analysis was the first step in the Forest Plan implementation process. These analyses identified needs and opportunities by management areas and were known as Step 2 Analysis. Previous NEPA documents were written for the same kinds of activities (timber harvesting, wildlife habitat restoration or maintenance, prescribed burning, and allotment management) in the same geographical area

as this project. The analyses done in these documents did not reveal any significant effects from the proposed activities. Post activity monitoring has verified that the analyses were compliant with the NEPA document and the effects were as displayed.

Site-Specific Environmental Analyses:

Within a portion of the Middle River Project Area:

- Dixie Vegetation Management, (2-18-93)
- Allotment Management Plans (7-7-93)

Past accomplishments within the Middle River Project Area include the following major activities by acres accomplished since 1986:

Table 1. Past Activities in the Middle River Project Area			
Uneven-aged Management (UEAM) Harvest	Prescribed Burning	Openlands Management	Old Growth Designation
150 Acres	609 Acres	475 Acres	83 Acres

Programmatic Documents

Mark Twain National Forest - Land and Resource Management Plan (LRMP) Final Environment Impact Statement and Record of Decision (Mark Twain National Forest 6/86, as amended).

The Forest plan is a programmatic document, which is required by the rules implementing the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA). The purpose of the Forest Plan is to provide direction for the multiple uses and the sustained yield of goods and services from National Forest System Lands (NFSL) in an environmentally sound manner.

The Forest Plan sets management direction for the Mark Twain National Forest through the establishment of short-term (10-15 years) and long-range goals and objectives through the year 2035. It prescribes the standards, practices, approximate timing and locations needed to achieve goals and objectives. The Plan prescribes the monitoring and evaluation needs necessary to ensure that direction is carried out, measures quality and quantity of actual operations against predicted outputs and effects, and forms the basis for implementing revisions.

The Secretary of Agriculture shall not be considered to be in violation of subparagraph 6(f) (5) (A) of the Forest and Rangeland Renewable Resources Planning (RPA) of 1974 (16 USC 1604(f) (5) (A)) solely because more than 15 years have passed without revision of the plan for a unit of the NFS (FY2002 Interior appropriations Bill, Section 327).

Following the signing of these earlier documents the Forest Plan has been amended to reflect new information concerning threatened, endangered, and sensitive species. This Project Analysis reflects those amendments and supplemental information reports to the Forest Plan.

The Mark Twain National Forest Programmatic Biological Assessment (Mark Twain National Forest September 1998) and Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray bat, Bald eagle, Indiana bat, and Mead's milkweed on the Mark Twain National Forest, Missouri (U.S. Fish and Wildlife Service, June 1999) were also incorporated into the analysis.

Other Documents:

The Mark Twain National Forest has recently completed several Supplemental Information Reports (SIR's) to evaluate information on Regional Forester Sensitive Species and salamanders.

On June 28, 2001 the Mark Twain National Forest completed a SIR on Regional Forester Sensitive Species. The analysis demonstrates how the 1986 Mark Twain National Forest Land and Resource Management Plan (Forest Plan) provides for ecological conditions that may lead to ensuring viable populations of these sensitive species. It concluded that the current Forest Plan adequately addresses habitat needs of all the species included on the list. By following the standards and guidelines in the current Forest Plan, the Mark Twain National Forest will provide habitat conditions conducive to maintaining viability of these species.

In March 2001, the Forest Service completed a SIR regarding information on plethodontid (lungless) salamanders. The report was revised in May 2001. The report was made in response to public concerns about recent articles describing the decline of these species and effects of silvicultural treatments on salamander populations. The SIR concludes that the 1986 Forest Plan addresses habitat needs for these species and acknowledged the importance of mature/over-mature forest with dead, downed, and rotten woody debris. The Forest Plan requires a certain percent of the Forest be maintained in mature and old growth forest, and protects special habitats such as springs, seeps, fens, fishless ponds, caves, and glades that may harbor salamander species.

This analysis is tiered to the following documents:

- The Mark Twain National Forest - Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision (6/86), as Amended, including all supplemental information reports.
- Glyphosate – Human Health and Ecological Risk Assessment Final Report. Prepared for the USDA, Forest Service by Syracuse Environmental Research Associates, March, 2003.

The following analysis are incorporated by reference:

The Mark Twain National Forest Monitoring and Evaluation Reports from FY 1987 through FY 2002.

Other Documents:

Weed Control Methods Handbook (April 2001)

Ozark-Quachita Highlands Assessment (December 1999)

National Fire Management Plan (January 2001)

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CHAPTER 2. ALTERNATIVES CONSIDERED

Alternative Development

Introduction

This chapter describes the alternatives to the proposed action and summarizes the environmental consequences of each alternative in relation to the Issues. Information in this Chapter will provide the decision maker with a range of alternatives to consider for the Middle River Project. It will include the analysis of the proposed activities and their anticipated effects. The process used to develop alternatives, the description of alternatives to be analyzed in further detail, a comparison of those alternatives and the reasoning for eliminating other alternatives that were considered from further analysis will be explored in this section of the EA

Formulation of Alternatives

The Interdisciplinary Team analyzed both internal and external comments received during the scoping and 30-day comment period. Alternatives were developed to respond to the unresolved issues as they related to the purpose and need for this project, laws, regulations, and policies that govern land use on the National Forest System lands. These alternatives represent different levels and types of management activities. The alternatives considered in detail; Alternative #1 (No Action), Alternative #2 (Proposed Action) and Alternative #3, display a range of options which could be implemented to manage the Middle River Project Area. Two additional alternatives were considered but eliminated from further study will be discussed later in this chapter. Management needs and opportunities as determined by on-the-ground investigations were also considered in this process.

Alternatives to the proposed action (Alternative #3) must meet the purpose and need as stated in Chapter 1 and address key issues described above. As well, a No Action Alternative must be included as one of the alternatives analyzed. The Interdisciplinary Team believes this additional alternative to the proposed action (Alternative #3), along with the Proposed Action Alternative (Alternative #2), represents the range of concerns of the Forest Service, local residents, other agencies, and members of the public that responded to the Forest Service during scoping and public involvement and provides a range of alternatives for the District Ranger to select from.

Alternatives to be Evaluated in Detail

The Forest Service developed three alternatives through Interdisciplinary Team input and analysis as well as public comments generated during scoping and the 30 day comment period. They include: Alternative #1 (No Action), Alternative #2 (Proposed Action) and Alternative #3. For a stand treatment listing, see Tables 4, 5 and 6.

Alternative 1 (No Action)

This alternative provides a baseline (reference point) against which to describe the environmental effects of the action alternatives. This is a viable alternative and responds to the concerns to keep the present openland management in place, with no additional activities taking place. The option for future management in this area would not be foreclosed.

The amount of existing openland (475 acres) would continue to exist in the area (which exceeds LRMP Desired Future Conditions objectives). Open land would not be planted to hardwood species and/or prescribed fire would continue to be utilized to keep areas in open/semi-open habitat.

If Alternative 1 is selected, current and on-going management activities would continue, such as openlands management through prescribed burning, grazing and mechanical means, but no new federal management activities would be initiated. However, no new old growth would be designated given that no project activities would be implemented. Changes, such as road maintenance, might occur through current management direction, natural processes, or other management decision in the future.

Alternative 2 (The Proposed Action)

This alternative includes the projects proposed through scoping. This alternative responds to the need to enhance wildlife habitats, improve watershed health and improve recreation. Below is a summary of actions (identified in Chapter 1) that would occur in Alternative 2:

Enhance Wildlife Habitat

- Provide existing open/semi-open habitat on 400 acres through mowing, prescribed fire, and grazing.
- Reduce open/semi-open habitat on 75 acres by planting hardwoods on approximately 45 acres of openlands and allowing the remaining 30 acres to naturally regenerate to native woody species by restricting prescribed burning.
- Designate an additional 107 acres for old growth wildlife species.
- Create woodland habitat in oak, oak-pine and pine sawtimber with 20-30% forbs, grass, and shrub on 460 acres through uneven-age harvests; contribute to this habitat on 250 acres by prescribed burning.
- Create 69 acres of 0-9 age class habitat through a portion of the preceding treatment.
- Provide diverse amphibian habitat through breaching and lowering one pond.

Note: All or portions of some of the acres may be treated with fire more than once in the following decade.

Watershed Health

- Restrict livestock from wooded acres by fencing.
- Reconstruct one pond and fence it to restrict cattle.
- Reconstruct approximately 0.9 mile of Forest Road 1686 to improve drainage crossing.
- Improve access in pastures with gravel.
- Close approximately 0.4 miles of non-system roads which exist in the project area.
- Reduce soil movement in three wooded draws by planting native vegetation or installing watershed control structures.
- Close 2 existing open wells.
- Maintain existing ponds.

Recreation Management

- Improve five parking lots with gravel.
- Construct interpretive cultural history signs.
- Install self-closing gate to improve access for dispersed recreation.

Associated or Connected Actions

- Construct fire lines for prescribed burns.
- Reduce non-native invasive and noxious weeds with herbicide spot treatment on 59 acres.
- Reduce hardwood planting competition by spot treatment on 45 acres to improve seedling survival.

Alternative 3:

This alternative was developed through Interdisciplinary Team input and analysis as well as public comments generated during scoping and the 30 day comment period and addresses the concerns of Issues 1 and 2. Some commenter would like to see existing open and semi-open wildlife habitat managed to encourage diverse plant structure (forbs, flowering plants) through prescribed burning and grazing. Therefore, the stand proposed for removal from grazing (Compartment 9, stand 14) is not proposed for planting in this alternative. However, the remaining stands proposed in Alternative 2 would be planted to trees or not burned to reduce the amount of openlands wildlife habitat.

Other commenter would like to see different blocks of old growth habitat. The IDT incorporated several of their comments and changed some stand boundaries to provide additional old growth habitat along drainages and a stand proposed for harvesting was placed into old growth habitat in Compartment 9. This would provide for a larger block of old growth near the Middle River. Another stand proposed for old growth in Compartment 10 was removed and proposed for uneven-aged management. This stand (Compartment 10, stand 13) had received uneven-aged management in the early 1990s and would benefit from follow-up treatment.

This alternative looks identical to Alternative #2 in all aspects except some changes to stands where individual and group harvests (uneven-age management) and connected actions would occur. It also reduces hardwood tree planting because an open field would be left open to grazing, and includes changes in stands proposed for old growth habitat.

Changes from Alternative 2 (the Proposed Action) include:

- Provide existing open/semi-open habitat on 430 acres through mowing, prescribed fire, and grazing.
- Reduce open/semi-open habitat on 38 acres by planting hardwoods on approximately 8 acres of openlands and allowing the remaining 30 acres to naturally regenerate to native woody species by restricting prescribed burning.
- Designate an additional 106 acres for old growth wildlife species for a total of 189 acres.

Chapter 3 will analyze the effects of the proposed changes on the various resources.

Comparison of Alternatives

This section provides a summary of the proposed projects for each alternative. Information in the table is focused on activities where different levels can be distinguished quantitatively or qualitatively among alternatives.

Table 2. Alternative Summary			
A. Wildlife Habitat Enhancement			
Proposed Actions	Alternative 1 (No Action) Acres*	Alternative 2 (Proposed Action) Acres*	Alternative 3 Acres*
1. Open Semi-open Habitat			
A1a. Provide Open/Semi-Open Habitat (Prescribed burn, Grazing, Mechanical treatments)	475	400	430
A1b. Plant Native Hardwoods and/or Reduce Prescribed Burning in Open/Semi-Open Habitat	0	75 (45 acres planted to hardwoods; 30 acres of open/semi-open habitat allowed to naturally regenerate)	38 (8 acres planted to hardwood; 30 acres of open/semi-open habitat allowed to naturally regenerate)
2. Old Growth Habitat			
A2. Designate habitat for wildlife species utilizing old growth	83 acres (previously designated)	190	189 (addition of C. 9, stand 25, plus stand boundary changes of 16 acres; remove C.10, Stand 13)
3. Provide Woodland Habitat in Oak Sawtimber in 20-30% forbs, grasses, and shrub ground cover.			
A3a. Uneven-aged Management	0	460	460 (changes in stands keep total acres similar)
A3b. Prescribed Burning	0	250	250
4. 0-9 Age class habitat			
A4. Provide Temporary Woodland Habitat in the 0-9 Age Class	0	69	69

Table 2. Alternative Summary

5. Diverse Amphibian Habitat			
Proposed Actions	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
A5. Provide Diverse Amphibian Habitat. Breach and Lower Pond	0	1 pond	1 pond
B. Watershed Health			
B1. Fencing to exclude livestock	No Fencing added	Fencing added	Fencing Added
B2. Pond Reconstruction	0 Ponds	1 Pond	1 Pond
B3. Reconstruct Forest Road 1686 to improve drainage crossing	0 Miles	0.9 Mile	0.9 Mile
B4. Improved Pasture Access with Gravel	0	4 Accesses	4 Accesses
B5. Close Non-System Road	0	0.4 Mile Closed	0.4 Mile Closed
B6. Construct Erosion Control Structure and/or Seed and Plant Native Vegetation	0	3 Structures and/or Plantings	3 Structures and/or Plantings
B7. Close Wells	0	2 Wells	2 Wells
B8. Pond Maintenance	As needed	As Needed	As Needed
C. Recreation Management			
C1. Improve Parking Areas	0	5 Sites	5 Sites

Table 2. Alternative Summary			
Proposed Actions	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
C2. Improve Interpretive Signing	0	1 Sign	1 Sign
C3. Improve Dispersed Access	0	1 Gate	1 Gate
D. Associated and Connected Actions			
D1. Fireline Construction	0	Approximately 1 mile	Approximately 1 mile
D2. Reduce Non-Native Invasive Noxious Weeds Use herbicides as spot treatments	0	Spot Treatment within 59 Acres	Spot Treatment within 59 Acres
D3. Reduce Competition in Hardwood Plantings Use herbicide in spot treatments	0	Spot Treatment within 45 Acres	Spot Treatment within 8 Acres

Acres* = All acres are approximate.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need, as discussed earlier in this chapter.

An alternative similar to Alternative 3, but with the addition of Stand 27 in Compartment 9, was considered. This alternative was generated from comments received during the public comment period. This alternative would increase the old growth habitat beyond the DFC. Commenter proposed this stand to old growth to maintain the remote character and beauty of this area. Harvesting methods proposed in this project area are all uneven-aged management, where individual and small groups of trees are selected, therefore retaining the overall forested quality of the area. Visual mitigations are also considered in any areas of harvest, and are discussed in the Visuals section of this document, as well as the mitigation section. Stand changes to

help maintain the visual integrity of the drainages in this area were included in Alternative 3. This included the proposal to create new stands from stands 33 and 53 in Compartment 9. This considered alternative does not provide a range of effects sufficiently different from Alternative 3, and will not be carried further into the analysis.

An alternative that is similar to the proposed action but does not commercially harvest the trees was considered. In this alternative all actions would be the same as our proposed actions except no removal of the cut trees would occur. This alternative was developed to respond to scoping issues related to commercial logging of National Forest System Lands. This alternative would respond to the purpose and need but was dropped because it is contrary to Forest Plan Direction as well as concerns for Forest Health and Wildland Interface (i.e. fuel load). This alternative would not be carried further into analysis.

Mitigation Common to All Action Alternatives

The following are mitigation measures in addition to the Forest Plan standards and guidelines. Mitigation measures identified with a “T” pertain to timber harvesting and an “M” refers to mechanical treatments. Those identified with an “F” pertain to fire.

Mitigation Measures - Heritage Resources (CR):

CR1 (T, M, F): Site Avoidance

Site avoidance is the preferred mitigation action pursuant to the Forest Plan, Section IV-30, 31 [also FSM 2361.21(2)]. Avoidance of cultural resources will be understood to require the retention of such properties in place and their protection from effects resulting from the undertaking [MOU 2002, Section II, H (2a, 2b)]. Effects will be avoided by implementing the following specific actions:

- (1) Establishing buffer zones around those sites in areas where harvest activities will take place [to include timber harvest as well as construction of skid trails and landings]; buffer zones will be of sufficient size to ensure that the integrity of the characteristics and values which contribute to, or may potentially contribute to, the properties' significance will not be affected.
- (2) Routing temporary roads away from archaeological sites.

CR2 (F): Site Protection during Prescribed Burns

(1) Firelines

Those archaeological sites located along existing woods roads that may be used as fire lines will be protected by hand-clearing those sections of the road/fireline that crosses the sites. Those sections of roads crossing archaeological sites will be cleared using leaf blowers and leaf rakes. There will be no removal of soil or disturbance below the ground surface during fireline preparation.

Archaeological sites and features that may be located along proposed routes of dozer-constructed firelines will be avoided by routing firelines around archaeological sites. Sites that lie along previously constructed dozer lines from past burns will be protected during future burns by hand clearing those sections of line that cross the sites, rather than re-clearing the lines using heavy equipment.

(2) Burn Unit Interior

Combustible elements at potentially eligible sites in the burn unit interiors will be protected from damage during the burns by removing fuels from the feature vicinity, and, where necessary, by burning out an area around the feature prior to igniting the main burns. Burning out is accomplished by constructing a set of two hand lines, approximately 30 to 50 ft. apart, around the feature and by then burning the area between the two lines while the burn is carefully monitored. A fuel-free zone is thereby created around the combustible elements. Any combustible features that might be located in a burn unit will also be fully documented with photographs and field drawings prior to the burn. A Heritage Resources Specialist will attend the pre-burn briefings, and Forest Service personnel will accompany any non-Forest Service crews that may participate in the burn.

Those sites containing above ground, non-combustible cultural features and exposed artifacts would be protected by removing by hand, any concentrations of fuels that might have built up on the sites and features. Where such fuel concentrations are not present, no mitigation is required.

No mitigation measures are proposed for any sites in the burn interior that do not contain combustible elements or other above ground features [as described in (a) and (b) above], because it is not expected that the burns proposed for the Middle River project area will harm these sites.

(3) Post-Burn Monitoring

Post-burn monitoring will be conducted at selected sites in order to assess the actual effects of the burns on the sites against the expected effects and to check for indirect effects at the sites following the burn. State Historic Preservation Office (SHPO) consultation will be carried out with respect to mitigation for any sites that suffer unexpected damage during the burn, or that are suffering damage from indirect effects following the burn.

CR3 (M): Road Maintenance

Where Forest Service Roads scheduled for maintenance cross archaeological sites, road work will be confined to the existing roadway and ditches.

CR4 (T,M,F): Survey of Landings, Temporary Roads, Skid Trails, Roads to be Reconstructed, Dozer-Constructed Firelines

If activities take place outside those areas not already included in cultural resource surveys, prior to project implementation, the cultural resource surveys will be completed. Appropriate measures as noted in CR1, CR2, and CR5 will be applied prior to project implementation to protect any archaeological sites that may be located in these areas. Consultation with the Missouri SHPO will be completed prior to project implementation.

CR5 (T, M, F): Other Mitigation Measures

If it is not feasible to completely avoid an archaeological site (CR1) and if mitigation measures outlined in CR2 and CR3 are not applicable, then the following steps will be taken:

(1) In consultation with the Missouri State Historic Preservation Officer (SHPO), the site(s) will be evaluated against National Register of Historic Places significance criteria (36 CFR 60.6) to

determine if the site is eligible for, or appears to be eligible for, inclusion in the National Register of Historic Places.

(2) In consultation with the Missouri SHPO, mitigation measures will be developed which will lessen, or minimize, the adverse effects on the site(s), so that a finding of No Adverse Effect results.

(3) The agreed-upon mitigation measures will be implemented prior to initiation of project activities that have the potential to affect the site(s).

CR6(T,M,F): Discovery of Cultural Resources during Project Implementation

Although the cultural resource surveys completed for this project are designed to locate all archaeological sites that might be eligible for the National Register, such sites may go undetected for a variety of reasons. Pursuant to the provisions found in 36 CFR 800.13, should any previously unidentified cultural resources be discovered during project implementation, activities that may be affecting that resource will be halted immediately. The resource will be evaluated by a professional archaeologist, and consultation will be initiated with the Missouri SHPO, as well as the Advisory Council on Historic Preservation, if required, to determine appropriate actions for protecting the resource and for mitigating any adverse effects on the resource. Project activities will not be resumed until the resource is adequately protected and until agreed-upon mitigation measures are implemented with SHPO approval.

Mitigation Measures - Air Quality (A):

A1 (F)

Prescribed burning would be completed during weather conditions that facilitate smoke dispersal. The public would be informed of the planned burning days and Forest Service employees would monitor for public safety hazards, if needed, along public travel ways.

Mitigation Measures – Fisheries (FS)

FS1

The foot trail crossing Middle River in the northeastern portion of the Project Area will be visited at least once per year to determine if any trail rutting is occurring. If trail rutting is occurring, erosion control measures, such as hardening of the site, water diversion berms, or limiting use at the site should be taken.

Mitigation Measures – Soil and Water (SW):

SW1 (T & M)

Temporary road and main skid trails would be located on the ground by Forest Service personnel prior to harvest operations, avoiding layouts that concentrate runoff into draws, ephemeral drainages, sinkholes or watercourses.

SW2 (T & M)

Proper grade and water control structures would be constructed and maintained on skid trails. Specifications that are indicated in the Missouri Department of Conservation's "Missouri Watershed Protection Practice" would be followed. Roads would not drain directly onto skid trails or into stream channels.

SW3 (T)

When logging is complete additional slash would be pulled onto skid trails.

SW4 (T)

Forest Service would suspend skidding during wet periods, when excessive rutting and churning of the soil begins or when runoff from skid trails is turbid and no longer infiltrates the forest leaf litter within a short distance from the skid trail.

SW5 (F)

Prescribed burn units should have as little mechanical disturbance to the soil before and just after burning as possible. Equipment would not use stream channels as “roads.” Where stream crossing is unavoidable it would be done in locations that would create the least impact on stream banks and beds.

SW6 (F)

Fire lines created with dozers would not be placed in riparian areas, fens, wetlands, or other sensitive habitats.

SW7 (F)

Fire lines would be seeded when necessary with a cover crop suited to area objectives and would be fertilized, if necessary, with standard fertilizer immediately after construction or as soon afterwards as to allow the best chance of germination. Water bars would be constructed in accordance with the Missouri Department of Conservation’s “Missouri Watershed Protection Practice” to minimize water movement along fire lines.

SW8 (T)

Trees anchoring stream banks of any distinct channel would not be cut unless they are species that are known to “sprout” from a cut tree’s roots, even if the stream does not require a buffer zone. This may include channels that are the result of road drainage ditches.

SW9 (T & M)

Reconstructed and temporary road constructions, which have potential to cause severe erosion, would have additional water protection mitigations as follows: Temporary roads that cross drainages would be closed as soon after the harvest or treatment as possible. All crossings would be constructed at right angles to the channel at locations chosen to have the least impact as possible on the stream channel and banks. Slash filter would be placed uphill from any drainage and used as filter at the outside of the water-bar nearest the drainage. If the crossing location is soft, it would be reinforced with aggregate.

SW10 (T & M)

No mechanical disturbance of the soil would occur on slopes greater than 35%.

SW11 (T, F & M)

Stands with soils that have perched water tables would have little to no mechanical disturbance to wet soil.

Mitigation Measures - Vegetation (V):**V1 (T)**

Log landings, major skid trails, and other areas where mineral soil is exposed would be seeded and fertilized if necessary for cover crop only. No non-native species would be seeded to provide permanent vegetation.

V2 (F)

Prescribed burn plans would incorporate burning conditions that best meet specific management area objectives to reduce fuel loads, stimulate forest regeneration, meet visual standards, and protect sensitive species. Prescribed burns may be conducted during the dormant (leaf-off) season, September 30 through April 15 according to standards and guidelines under 5100 Fire Management, and as frequently as necessary to meet management objectives as determined through annual evaluations of initial and subsequent burn treatments.

V3 (T & M)

A buffer zone of at least 50 feet in radius would be retained in association with seeps, fens, springs, and any other special features or habitats. Skidding and decking would be prohibited within these buffer zones.

Mitigation Measures - Wildlife (WL):**WL1 (F)**

In order to reduce and/or eliminate any potential destruction of nests from flames or disturbance from smoke, no prescribed burning would occur between the dates of April 15 and September 30. This mitigation measure is for the Pileated woodpecker, Ovenbird, Turkey, Bobwhite Quail, Orchard Oriole, Wood Thrush, Ruffed grouse, Indigo bunting and the Eastern Bluebird.

WL2 (F, T)

To the maximum extent possible and logistically practical, maintain, on average, a minimum of 23 suitable roost trees per acre for bats on forested acreage. Suitable roost trees contributing to the minimum listed above may include the following: 1) live shagbark and shellbark hickories ≥ 9 " dbh, 2) lightning struck trees ≥ 9 " dbh and trees, 3) dead or dying trees ≥ 9 " dbh with at least 10% exfoliating or defoliating bark, 4) den or cull trees, and 5) live trees ≥ 26 " dbh. Of the 23 roost trees maintained, to the maximum extent possible and logistically practical, retain existing dead trees ≥ 20 " dbh and all live trees ≥ 26 " dbh unless they are an immediate human safety hazard. A canopy closure of 60-80% must be maintained. Special precautions are to be taken to protect large snags (≥ 16 " dbh) which are not safety hazards; such snags should be protected from fire and smoke. Wind direction, speed, mixing height and transport winds are to be used during burn planning and implementation to minimize smoke intensity and duration of burns.

WL3 (T&F)

Upon the discovery of an eagle communal night roost or eagle nest, or Indiana or Gray bat maternity sites at any time during the course of activities described in this EA, activities would be halted until the USFW Service has been contacted. At this point consultation may be reinitiated and an amended BE may be prepared. This could lead to a designated protective buffer around the roost or site in accordance with the Forest Plan.

WL4 (T)

A buffer zone of at least 50 feet in radius would be retained in association with seeps, fens, springs, and any other special features or habitats. Skidding and decking would be prohibited within these buffer zones.

WL5(T)

No cutting of any Butternut tree(s) would occur in the Middle River Project area. This is to protect and retain any potential Butternut trees that have not already been killed by the Butternut Canker.

Mitigation Measures - Visuals (VS):

In order to reduce potential negative impacts to the view, the specified mitigating measures would be used for the following areas in the designated foreground seen area for any action alternative:

VS1 (T & M)

The negative visual impacts will be mitigated concurrently with or immediately after each phase or activity. Mitigating measures will be completed for each cutting unit or project area before beginning activities in the next sequential block or project area in the same corridor/viewshed. The total lapsed time from initiation of activities to completion of obligations specified by a contract or a project prescription shall not exceed two years for any single cutting unit or project area. Emphasis will be placed on completing all work within these areas in a systematic manner within the shortest practical time (page IV-31 Forest Plan).

VS2 (T)

All harvest areas would be laid out on the ground in a manner that would reflect natural lines and be visually subordinate to the characteristic landscape.

Mitigation Measures Common to All Action Alternatives:

The application of herbicides is controlled by state and federal agencies. The Forest Service is required to follow all state and federal laws and regulations concerning the use of herbicides. Forest-Wide Standards and Guides on page IV-23 –24 are included by reference. The following measures and design features are common to all alternatives involving the use of herbicides:

Mitigation Measures – Invasive Plants (IP):

IP1: Prevention measures prescribed in Forest Service Guide to Noxious Weed Prevention Practices (USFS 2001) would be followed during agency activities to minimize invasive plant introduction and spread on the Forest. This would be the single most effective and least expensive weed management option available.

IP2: If restoration of treated areas included establishing new plants, this would be accomplished by broadcast seeding of native species.

IP3: All sites treated for non-native invasive species would be monitored as described in the monitoring section in Chapter 4. A monitoring plan would be prepared as part of each treatment activity. Baseline monitoring to determine existing conditions would occur prior to treatment. Implementation monitoring would occur during treatments to insure design and safety standards are followed. Monitoring would be designed to insure that surveys for occupied and potential habitats for sensitive plants and animals have been conducted prior to weed treatment activities.

IP4: Projects would be supervised by state-certified applicator that would be responsible for insuring safe handling, worker protection, application and disposal of herbicides.

IP5: Herbicides would be applied only by ground-based equipment in spot treatments.

IP6: All requirements in a Safety and Spill Plan would be followed.

IP7: Areas treated with pesticides will be signed, as appropriate, to ensure users are informed of possible exposure.

Issue Comparison

Table 3: Comparison of Issues				
Issue	Measure	Alternative 1	Alternative 2	Alternative 3
Issue 1: Openlands Management	Acres Decrease in Open/Semi-Open Habitat	0	75	38
Issue 2: Old Growth Habitat	Total Acres in designated Old Growth habitat	83	190	189

Proposed Treatment Comparisons

Treatment Comparisons for the three alternatives are documented in Tables 4, 5 and 6.

Table 4: Alternative 1 (No Action) – Compartment/Stand Treatment Table			
Existing Management	Compartment	Stand Number	Measure (estimated)
Provide Open/Semi-Open Habitat (Combination of prescribed burning, grazing, mechanical treatments)	9	1,4,6,8,14,20,22,23,28,37, 38,39,42,47,56	475 Acres
	10	2,14,16,17,24,25,27,29	

Table 5: Alternative 2 (Proposed Action) -- Compartment/Stand Treatment Table			
A. Wildlife Habitat Enhancement			
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
1. Open Semi-open Habitat			
A1a. Provide Open/Semi-Open Habitat (Prescribed Burning and/or Grazing, Mechanical Treatment, Seeding, Fertilization, and Fencing as needed)	9	20,22,23,28,38,39,42,47,56	400 AC
	10	2,14,16,17,24,25,27,29	
A1b. Plant Native Hardwoods and/or Reduce Prescribed Burning in Open/Semi-Open Habitat	9	Plant Hardwoods in Stands 1,8 and 14; Do not Burn Stands 4,6,14, and 37.	75 AC (Plant 45 acres; allow 30 acres to naturally regenerate to woody habitat)
2. Old Growth Habitat			
A2. Designate habitat for wildlife species utilizing old growth	9	2,16,17,32,34,54,55	190 AC
	10	5,9,10,11,12,13	
3. Provide Woodland Habitat in Oak Sawtimber in 20-30% forbs, grasses, and shrub ground cover.			
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
A3a. Uneven-aged Management	9	7,10,11,12,18,19,25,27,30 33,35,36,40,41,44,45,46,53	460 AC
	10	1,3,4,6,7,8,19,20,30,31,35, 36	
A3b. Prescribed	9	16,17,21,24,25,26,27,30,	

Table 5: Alternative 2 (Proposed Action) -- Compartment/Stand Treatment Table			
Burning	10	31,32,40,41,43,45,46,48, 49,53,55 26,28,32	Total 250 AC
4. 0-9 Age class habitat			
A4. Provide Temporary Woodland Habitat in the 0-9 Age Class See A3a above	See A3a above	See A3a above	Actions in A3a contribute to this habitat for 69 AC
5. Diverse Amphibian Habitat			
A5. Provide Diverse Amphibian Habitat Breach and Lower Pond	9	52	1 pond
B. Watershed Health			
B1. Fencing to exclude livestock	9 10	22,24,30,31,41 23,31	Fencing Added
B2. Pond Reconstruction	9	50	1 Pond
B3. Reconstruct Forest Road 1686 to improve drainage crossing	9	18,19,22,24,28,42	0.9 Miles Road
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
B4. Improved Pasture Access with Gravel	9 and 10	As Needed	4 Accesses
B5. Close Non-System Road	9	2	0.4 Mile
B6. Construct Erosion Control	9	14, 44	

Table 5: Alternative 2 (Proposed Action) -- Compartment/Stand Treatment Table			
Structure and/or Seed and Plant Native Vegetation	10	24	3 Structures
B7. Close Wells	9	28,41	2 Wells
B8. Pond Maintenance	9 and 10	As Needed	Ponds Maintained
C. Recreation Management			
C1. Improve Parking Areas	9 10	1,42,47 2,25	5 Sites
C2. Improve Interpretive Signing	9	42	1 Sign
C3. Improve Dispersed Access	9	37	1 Gate
D. Associated and Connected Actions			
D1. Fireline Construction	9 and 10	See Treatment Descriptions A1 and A3	Approximately 1 Mile
D2. Reduce Non-Native Invasive Noxious Weeds Use herbicides as spot treatments	9	47,56	Spot Treatment within 59 AC
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
D3. Reduce Competition in Hardwood Plantings Use herbicide in spot treatments	9	1,8,14	Spot Treatment within 45 AC

Table 6: Alternative 3 – Compartment/Stand Treatment Table			
A. Wildlife Habitat Enhancement			
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
1. Open/Semi-Open Habitat			
A1a. Provide Open /Semi-Open Habitat (Prescribed Burning and/or Grazing, Mechanical Treatment, Seeding, Fertilization, Fencing as needed)	9	14, 20,22,23,28,38,39,42, 47,56	430 AC
	10	2,14,16,17,24,25,27,29	
A1b. Plant Native Hardwoods and/or Reduce Prescribed Burning in Open/ Semi-Open Habitat	9	Plant Hardwoods in Stands 1, and 8; Do not burn Stands 4,6 and 37	38 AC (Plant 8 acres; allow 30 acres to naturally regenerate to woody habitat)
2. Old Growth Habitat			
A2. Designate habitat for wildlife species utilizing old growth	9	2,16,17,25, 32,34,54,55 (stand boundary changes to stands 33 and 53)	189 AC
	10	5,9,10,11,12	
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
3. Provide Woodland Habitat in Oak Sawtimber in 20-30% forbs, grasses, and shrub ground cover.			
A3a. Uneven-aged Management	9	7,10,11,12,18,19,27,30 33,35,36,40,41,44,45,46, 53	460 AC
	10	1,3,4,6,7,8,13,19,20,30,31, 35,36	

Table 6: Alternative 3 – Compartment/Stand Treatment Table			
A3b. Prescribed Burning	9 10	16,17,21,24,25,26,27,30, 31,32,40,41,43,45,46,48, 49,53,55 26,28,32	Total 250 AC
4. 0-9 Age Class habitat			
A4. Provide Temporary Woodland Habitat in the 0-9 Age Class See A3a above	See A3a above	See A3a above	Actions in A3a contribute to this habitat for 69 AC
5. Diverse Amphibian Habitat			
A5. Provide Diverse Amphibian Habitat Breach and Lower Pond	9	52	1 pond
B. Watershed Health			
B1. Fencing to exclude livestock	9 10	22,24,30,31,41; 23,31	Fencing Added
B2. Pond Reconstruction	9	50	1 Pond
B3. Reconstruct Forest Road 1686 to improve drainage crossing	9	18,19,22,24, 28,42	0.9 Miles Road
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
B4. Improved Pasture Access with Gravel	9 and 10	As Needed	4 Accesses
B5. Close Non-System Road	9	2	0.4 Mile
B6. Construct Erosion Control	9	14, 44	3 Structures

Table 6: Alternative 3 – Compartment/Stand Treatment Table			
Structure and/or Seed and Plant Native Vegetation	10	24	
B7. Close Wells	9	28,41	2 Wells
B8. Pond Maintenance	9 and 10	As Needed	Ponds Maintained
C. Recreation Management			
C1. Improve Parking Areas	9 10	1,42,47 2,25	5 Sites
C2. Improve Interpretive Signing	9	42	1 Sign
C3. Improve Dispersed Access	9	37	1 Gate
D. Associated and Connected Actions			
D1.Fireline Construction	9 and 10	See Treatment Descriptions A1 and A3	Approximately 1 Mile
D2. Reduce Non-Native Invasive Noxious Weeds Use herbicides as spot treatments	9	47,56	Spot Treatment within 59 AC
Treatment Description	Compartment	Stand Numbers	Measure (estimated)
D3.Reduce Competition in Hardwood Plantings Use herbicide in spot treatments	9	1,8	Spot Treatment within 8 AC

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CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This Chapter summarizes the existing condition of the physical, biological, social and economic environments of the Middle River Project Area. It also displays the effects of implementing each alternative on that environment and presents the scientific and analytical basis for the comparison of alternatives presented in the previous chapter. Specialists considered direct, indirect, and cumulative effects to evaluate both short-term uses and long-term productivity. Refer also to Appendix C for a discussion of biological diversity and the environmental effects of the proposed activities.

The Final Environmental Impact Statement (FEIS) that accompanied the programmatic Forest Plan disclosed the effects, including cumulative effects, of management practices in a forest-wide context. This Environmental Assessment of the Middle River project discloses the effects of implementing the proposed action and its alternatives and is tiered to the Mark Twain National Forest Land and Resource Management Plan FEIS and subsequent amendments.

The Analysis Area boundary was delineated by the Sub-Management Area 3.4-9. The direct and indirect effects would include those identified in the project area and the existing conditions within the MAs boundaries and Landtype Associations.

The cumulative effects include "...the impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40CRF section 1508.7). This includes determining the geographic (spatial) and time (temporal) boundary cumulative effects analysis area boundaries. This is to ensure that the cumulative effects are measurable and meaningful and that the decision makers will be completely informed about the consequences of their actions (CEQ 1997 – Considering Cumulative Effects under NEPA). *Note: The cumulative effects need to be evaluated separately for each resource. Therefore the cumulative effects may vary between resources, including the spatial and temporal boundary.*

Information regarding past Forest Service activities in the Middle River Project Area can be found on page 2 and in Table 1 of this document.

The activities identified in Alternatives 2 and 3 (Chapter 1 and 2) are the same or similar to previous activities implemented on the Houston/Rolla/Cedar Creek Ranger District (See Relationships to Other Documents in Chapter one). Therefore, any effects would be the same or very similar to ones which have already been observed.

NOTE: The Forest Service also developed mitigation measures to be used as part of all of the action alternatives. For simplicity, all mitigation measures are compiled from each resource discussion into a listing in Chapter 2 of this document. Like mitigation measures, all monitoring would be compiled from each resource discussion into a listing at the end of Chapter 4 of this document.

Background

Ecological Patterns and Processes

The purposes of The National Environmental Policy Act is to encourage productive and enjoyable harmony between humans and their environment; to promote efforts that would prevent or eliminate damage to the environment, to stimulate the health and welfare of humans, to enrich the understanding of the ecological systems and natural resources important to the United States of America. Understanding ecological systems, their patterns on the landscape, and natural processes is fundamental toward understanding challenges in managing healthy natural resources.

The Middle River Project Area is located at the northern edge of the Oak Hickory Hills Landtype Association (LTA) in the Outer Ozark Border Subsection, Ozark Highlands Section, Eastern Broadleaf Forest (Continental) Province, Hot Continental Division, and Humid Temperate Domain. It is located near the southern boundary of the Oak-Bluestem Plains LTA. The LTA information is from the MTNF LRMP and section, province, division and domain are referenced in the Ecoregions and Subregions of the United States, USDA, 1994. The Analysis Area is situated in the Houston/Rolla/Cedar Creek Ranger District of the Mark Twain National Forest. The following table summarizes the hierarchical ecological stratification of lands situated on this district:

Table 7: Hierarchical Ecological Classification			
HIERARCHY	General Size/Range	HOROCC District	Planning Level
Domain	Two or more states	Humid Temperate	National Planning Level
Province	Multi-state – Thousands of square miles	Eastern Broadleaf Forest (Continental) Province	National Planning Level
Section	Thousands of square miles	Ozark Highlands	National Planning Level
Subsection	Hundreds of square miles	Outer Ozark Border	Forest Planning Level
Landtype Association (LTA)	1 to 100's of square miles	Oak Hickory Hills	Forest Planning Level
Ecological Landtype (ELT)	10 – 100's of acres	Various Locations	Project Planning Level

Landtype Associations, Ecological Landtypes, and Terrestrial Natural Communities

LTA's are based on variations within each subsection in local landform, relief, geologic parent materials, soils, and potential natural vegetation. Within these LTA's are described lower/smaller ecological units called Ecological Landtypes (ELT's). Ecological landtypes are delineated based on landform, soils, and vegetation. Nine landforms are described on the basis of slope gradients and slope aspect.

Ecological landtypes are rather constant in terms of their physical slope, aspect, soils, and geology of the land surface. However, historic natural processes (especially fire and native herbivory) influenced the shape and character of terrestrial natural communities occurring on these ELT's. The interaction of historic fires in relationship to the relative position of the landform (ELT) generally determined whether the vegetation structure was open and park like (open oak woodlands on southwest-facing slopes and flat ridge tops) or dense and closed canopy forests found on north or east slopes and river bottoms. Widespread historic fire crossed LTA and ELT lines excepting larger streams and rivers. Understanding the relationship between natural processes, landform, soils, and native vegetation gives a general picture of resource capability; helps predict potential natural community patterns that were historically prevalent; and then sets management objectives and strategies in restoring forest health.

Natural communities and habitats within the Middle River Project Area primarily comprised of Ozark biota are mixed with the biota of the adjacent natural divisions and the influence of the Missouri River. The "The Biodiversity of Missouri..." (March, 1992) report describes that the geologic and topographic variety of this region has a diversity of community types second only to the Ozarks. Today, however, the forests of the region are more closed and less biologically diverse than the more open oak woodlands of the past. Upland forests once dominated the landscape of the Ozark border, especially in the rivers hills. On more gentle topography, these forests graded into savanna and prairie. Historical accounts of the region describe open, park-like forests north of the Missouri River. Occasional springs, caves, and sinkholes, similar to those found in the Ozarks, harbor distinctive communities.

Forest Plan Management prescriptions for the Wildlife Vegetative Condition objectives may vary between LTA and Management area.

Oak-Hickory Hills LTA: This area is located in the Upper Ozarks region and has a limestone parent material. It includes gently sloping to steep uplands that occupy narrow stream divides. Local relief is between 150 and 300 feet. The slopes are generally less than 30 percent. The area has a medium tall to tall broadleaf deciduous forest. The dominant tree species are white oak, northern red oak, black oak, sugar maple, and Shagbark hickory. The primary associated ELT's within the project include: upland forest, side slopes (ELT 51, 52, 53, 55), upland mesic forest (ELT 56), loess-derived upland forest (ELT 54), limestone-derived forest on side slopes (ELT 57), colluvium-derived forest on side slopes (ELT 58), loess-derived broad ridges in openlands, (ELT 60), alluvium-derived upland forest associated with waterways (ELT 61), and bottomland forest and floodplains (ELT 62).

Terrestrial Natural Communities

The following natural communities are represented in the Middle River Project Area, based on "The Terrestrial Natural Communities of Missouri". The majority of the upland acres are classified as "Limestone/Dolomite Forest". This is subdivided into dry-mesic, on upper and mid slope and most ridge tops; mesic, on steep lower slopes and ravines; and dry, on south and west aspects and crest of ridges.

Natural vegetation in this landscape is oak/hickory forest, with the higher moisture sites containing the richer species mixture, lush herbaceous ground cover and taller tree growth. Approximately 98% of the upland forests are contained in the above categories. On the drier sites, species composition in these forests consists of post oak, associated with white oak and chinquapin oak, with more open, less herbaceous ground cover and understories. These are the sites in which oaks most easily reach dominant positions. The moist end of the scale contains more white oak, associated with black oak and northern red oak. Understories

contain more tolerant, midstory trees, and herbaceous ground cover is abundant. Light is more limited in these settings both due to landscape orientation, and prolific overstory and midstory crowns, thus oaks often are lacking in the small size classes.

The remaining 2% of the upland forests are classified “Xeric Limestone/Dolomite Forest”. These are comprised of cedar, cedar/hardwoods and associated hardwoods of chinquapin oak, white ash, etc. This type is restricted to bluffs, and exposed steep slopes with soil depths from 0 –15 inches.

In river bottomland and side drainage hollows, the natural vegetation was also forest. These forests are classified as “Dry-Mesic Bottomland Forests” where alluvial soil is deposited in flash flooding type events and soils have significant dry periods; and “Mesic Bottomland Forests” associated with permanent streams, where alluvial soils remain generally moist through much of the year. Vegetation in these bottomland forests contains the upland oaks in combination with black walnut, ash, and hickory on the drier sites, to more silver maple, river birch, and sycamore on the wetter locations. Drier sites often contain many woody shrubs in combination with an early spring flush of perennial plants that becomes fairly sparse in the drier summer months. Wetter sites maintain a well-developed understory and dense ground cover through the entire growing season.

FOREST PLAN DESIRED FUTURE CONDITION OBJECTIVES

Existing Condition

The Mark Twain National Forest established Desired Future Condition (DFC) objectives (LRMP IV – 120) for Management Prescription 3.4. These numbers are displayed as a percentage. *Note: See Table 8 for additional information.*

Woodland Habitat in 0-9 age class includes early successional forest habitat. This habitat may be created in small openings of group selection harvest under the uneven-aged silvicultural system (no even-aged management is allowed in Cedar Creek Unit per the MTNF LRMP). This habitat is important for Management Indicator Species (MIS) indigo bunting, bobcat, and deer and for neotropical migratory birds such as blue-winged warbler, prairie warbler, and white-eyed vireo. Currently, the DFC is not being met.

Woodland Habitat in Old Growth includes pine forest that is aged 80 years or more, or oak-hickory/oak-pine forest that is aged 90 years or greater. Important old growth characteristics include large, old trees, multi-layer canopy, dead and downed trees, and den/cavity trees. Allowing areas to grow older with little or no vegetation manipulation creates this habitat. Areas can be designated as old growth through a NEPA decision or through the absence of even-age vegetation management. Good old growth areas are fairly large to minimize outside influences and maximize forest interior, include a variety of ecological land types, and may include permanent streams, bottomland hardwoods, cave entrances, or other special habitats. Approximately 87 terrestrial species (MTNF Wildlife Habitat Evaluation Handbook, 1/86), including MIS pileated woodpecker, turkey, raccoon, wood thrush, bobcat and deer use old growth habitat. Currently, the DFC is not being met.

Woodland Habitat over 50 years habitat is oak-hickory and oak-pine forest 50 years of age or greater. It is important to have this mast-producing habitat in both the red and white oak groups, since they produce

acorns on different schedules and with varying amounts and sizes. Hickory nuts are also an important component of mast-producing habitat. There is generally an abundance of this habitat in most of the land-type associations on the MTNF. Mast is an important winter food for many of Missouri's winter residents, including MIS white-tailed deer, turkey and raccoon, as well as blue jays, gray squirrels, and southern flying squirrels.

There is generally an abundance of this habitat in most of the landtype associations on the MTNF. However, the Cedar Creek Unit consists predominately of old farms and the amount of older trees is lacking when compared to other parts of the MTNF. Currently, the DFC is not being met.

Woodland Habitat in pole and sawtimber size classes with a crown closure over 80 % occurs naturally on all except the most xeric sites. This habitat is important for species associated with large tracts of forest and generally closed canopy. It is associated with MIS pileated woodpecker, but may also be used by ovenbird, black bear, great horned owl, barred owl, red-eyed vireo and timber rattlesnake among others. Currently, the DFC standard is being exceeded.

Woodland Habitat in Oak, Oak-Pine, and pine sawtimber with 20-30% forb, grass, shrub ground cover provides a variety of soft mast, seeds and forage for MIS turkey and provides habitat for at least 60 other species including yellow-billed cuckoo and gray fox. Currently, the DFC is not being met.

Woodland Habitat in oak type over 50 years with a dense understory. This mature forest with dense understory (greater than 60% trees and tall shrubs) is usually associated with mesic forest on north and east facing slopes and in bottomlands. Wood thrush and ruffed grouse are MIS associated with this habitat, which is used by about 74 species including salamanders, wood frog, ruby and golden-crowned kinglets, black bear and others. Currently, the DFC is not being met.

Open and semi-open habitat consists of non-forested areas (old fields, created openings, warm-season grass fields, food plots, open and partially open glades, pastures, savannas and open woodlands). These habitats may exist naturally or may have been created by humans (either before or after acquisition as National Forest lands). Methods used to maintain them include prescribed fire, mechanical (bushhog, plow and seed, mow), manual (chainsaw, ax), or grazing. These habitats are important for MIS eastern bluebird, orchard oriole, cottontail rabbit, northern bobwhite, and will be used by MIS deer, turkey, raccoon, and bobcat. They are also important habitat for northern harrier, loggerhead shrike, red fox, coyote, redheaded woodpecker and others. Currently, the amount of open and semi-open areas are at 37%. Currently, the DFC standards is being exceeded. *Note: From analysis in the late 1980s in the MP 3.49, 45% of the area consisted of open and semi-open areas. Therefore, the amount of open and semi-open areas have been declining.*

Permanent water sources include natural and constructed waterholes, springs, seeps, fens, and permanent streams or rivers. These are generally very small (about 1/10 acre) and fairly shallow (less than 10 feet deep). A small opening may surround some, while others are constructed within a forested stand. Maintaining these waterholes can include removing woody vegetation from the dam so roots will not breach it, hinge-falling one or more trees into the water to provide habitat for aquatic wildlife, or dredging sediment from the bottom of the waterhole to deepen it. These constructed waterholes are important as drinking water for many wildlife species. Currently, the DFC is being exceeded.

Table 8: Desired Future Condition Comparison*(NUMBERS DISPLAYED IN PERCENT)*

	Desired Future Condition	Alternative 1 (Existing condition)	Alternative 2	Alternative 3
Woodland Habitat in 0-9 age class	8 - 15	1 *	5	5
Woodland Habitat in Old Growth **	10 - 15	6	15	15
Woodland Habitat over 50 years ***	45 - 55	28	28	28
Woodland Habitat in pole & sawtimber size classes with a crown closure over 80 %***	25 - 35	49	34	34
Woodland Habitat in Oak, Oak-Pine, and pine sawtimber, with 20-30% forb, grass, shrub ground cover	40 – 50 of sawtimber	6	31	31
Woodland Habitat in oak type over 50 yrs. With a dense understory ***	10 - 15	3	19	19
Open and Semi Open Habitat	10 - 20	37	31	32
Permanent Water Sources (number)	1 - 4 sources/mile (2-8 total)	10	9	9

* There is some uneven-aged harvest which provides some 0-9 habitat. However, due to plant succession these areas will no longer meet the 0 – 9 age class criteria by 2005.

** Designated Old growth acres are displayed.

*** The Middle River Breaks portion of the Oak Hickory Hills LTA, is generally younger than other portions of this LTA. As the forest continues to mature, there will be an increase of Woodland Habitat over 50 years of age.

Direct and Indirect Effects on Desired Future Condition by Alternative

Items common to all alternatives:

No one single habitat is good or bad for all species. Numerous species may be found in several habitats. A diversity of habitats is ideal. *Note: The Middle River Breaks portion of the Oak Hickory Hills LTA is generally younger than other portions of this LTA. As the forest continues to mature, there will be an increase of Woodland Habitat over 50 years of age.*

Alternative 1 (No Action):

The Middle River area would continue not to meet the DFC for Woodland Habitat in 0-9 age class, Woodland Habitat over 50 years old, Woodland Habitat in Oak, Oak-Pine, and pine sawtimber with 20-30% forbs, grass, shrubs ground cover and Woodland Habitat in oak type over 50 years old and with a dense understory.

The Middle River area would continue to exceed the Forest Plan DFC for Woodland habitats in pole and sawtimber size classes with crown closures over 80 percent and the amount of permanent water sources per square mile. The Middle River area would continue to exceed the DFC for open and semi-open areas. There would be no reduction in the amount of open and semi-open areas.

Alternative 2 and 3:

These alternatives would not meet the DFC for Woodland Habitat in 0-9 age class. With no even-aged management, the options available for creating Woodland Habitat in 0-9 age class are limited. However, they would move the Middle River Project Area closer towards meeting the DFC for Woodland Habitat in 0-9 age class.

Both alternatives would meet the DFC for Woodland Habitat in Old Growth, Woodland habitat in pole and sawtimber size classes with crown closures over 80 percent and Woodland Habitat in oak type over 50 years old and with a dense understory. This would benefit numerous species including salamanders.

These alternatives would move the Middle River Project Area closer to meeting the DFC for Woodland Habitat in Oak, Oak-Pine, and pine sawtimber with 20-30% forbs, grass, shrubs ground cover.

These alternatives would continue to reduce the amount of Open and semi-open habitat in the Middle River Project Area. This would move the Middle River Project Area closer to meeting the DFC for Open and Semi-open areas in future years.

These alternatives would slowly reduce the amount of permanent water sources in the Middle River area. This would move the Middle River Project Area closer to meeting the DFC for permanent water sources in future years.

Cumulative Effects on Desired Future Condition

A cumulative effects spatial boundary includes Forest Service lands in Compartment 9 and 10 of the Middle River Breaks portion of the Oak Hickory Hills LTA. The DFC applies to Forest Service lands only. In

addition there are no privately owned lands located within the boundaries of Forest Service lands in Compartment 9 and 10. Private land acreage is not considered in the calculations of the DFC.

A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

A stand replacing wildfire could occur at any time. This could greatly modify the landscape, thereby resulting in other portions of the Middle River area meeting or not meeting the Desired Future Condition.

Land clearing and/or land use modifications on the existing adjacent private lands can also modify the surrounding habitat. Most of the recent land changes in the area are new home construction on five to ten acre tracts.

Activities such as insects and disease, storms and drought, grazing, timber harvest, haying, noxious weed invasions, wildfire, fishing, hunting, horseback riding, hiking, and fire suppression may continue to modify the landscape. These could change how the area meets or does not meet Forest Plan DFC standards.

PHYSICAL ENVIRONMENT

SOIL

Existing Conditions

The project areas lie within the Salem Plateau physiographic region of the Ozark Province and within the Dissected Till Plains physiographic region of the Central Lowlands Province. (Mark Twain National Forest, Ecological Classification System, Cedar Creek Unit) The Atlas of Missouri Ecoregions show the project area lies within the Central Missouri Savanna/Woodland Dissected Plain of the Outer Ozark Border Subsection of the Ozark Highlands Section (Nigh and Schroeder 2002).

The soils of the area are typically very deep, well-drained mineral soils, which have formed in residuum and colluvium from the local sandstone and dolomite bedrock. Alluvial soils, which consist mainly of stratified silt, sand, and gravel are usually found on the valley floor floodplains. These soils are usually well-drained, although valley bottoms within the project area and areas with perched water tables can have areas of poor drainage. Many of the soils, particularly those on steeper ground, have very gravelly or stony surfaces and are skeletal (more than 35 percent rock fragments by volume) throughout the profile.

There are thirteen soil types, which occur on or adjacent to the project area for all alternatives. They are described in the tables in the appendix or can be found in the project file. Management considerations describe soil characteristics that may be affected by implementation of the proposed action or may affect implementation of the proposed action. The primary management considerations are for those soils which have perched, seasonal, or apparent high water tables. The soils on or adjacent to the project area do not have fragipans in their profile as various soils in the southerly Mark Twain National Forest units have. These other soils with high water tables occur because of their position on the landscape. These soils are often mapped in associations with other soils which may or may not have high water tables but occurred so intricately with these other soils on the landscape that mapping each separately would have proved impractical. These soil types include Armstrong loam, Calwoods silt loam, Gorin silt loam, Keswick loam,

Mexico silt loam, and Weller silt loam. Other soil types are located on stream terraces, floodplains, and some footslopes. Due to their location, these areas may experience frequent, brief flooding during the winter and early spring months. The soils on these areas are Cedargap gravelly silt loam, Haymond silt loam, and Landes fine sandy loam. Gasconade flaggy clay loam/Goss gravelly silt loam/rock outcrop complexes occur on upland landscapes and steep sideslopes and are located on 75 percent of the stands in Compartments 9 & 10. Due to the low available water holding capacity, shallow A horizon, and high rock content throughout the profile, the soil productivity of this complex is generally low. Bethesda silty clay loam intermingled with mine dumps are located on two stands in Compartment 9 where treatments are planned. Nearly every stand where the proposed actions are to be implemented has a number of soil types and some of these will have high water tables. Their presence does not preclude proposed actions if mitigation measures outlined in this environmental assessment and in the Forest Plan are employed. The soils tables in the appendix give their location and are given for all stands in Compartments 9 & 10. This was done to give a landscape picture of where these soils occur.

Ecological land types (ELT) were analyzed as well. Ten Ecological Land Types occur on or adjacent to the project areas. These ELT's are all restricted to the glacial till area north of the Missouri River and do not occur in the southerly Mark Twain National Forest Units.

- ELT 51 occurs typically on moderately steep to steep slopes with deep, loamy well drained soils developed from glacial till.
- ELT 52 occurs on moderately steep to very steep north and east facing side slopes with deep cherty soils developed from cherty dolomite and/or limestone residuum.
- ELT 53 is similar to ELT 52 with the exception that it occurs on south and west facing side slopes.
- ELT 54 occurs on gently rolling narrow ridges with deep clayey moderately well to well drained soils developed from loess.
- ELT 55 typically occurs on gently sloping to moderately steep side slopes with deep clayey well-drained soils developed from glacial till.
- ELT 57 occurs on moderately steep to very steep side slopes with very shallow soils developed from cherty dolomite and/or limestone.
- ELT 58 occurs on gently sloping to moderately steep colluvial slopes with loamy well drained soils developed from colluvium.
- ELT 60 typically occurs on gently rolling broad ridges with deep clayey somewhat poorly drained soils developed from loess.
- ELT 61 typically occurs on narrow upland waterways with loamy somewhat poorly drained soils developed from alluvium.
- ELT 62 typically occurs on stream bottoms with loamy well-drained soils developed from alluvium.

The other management consideration is soils on steeper slopes. These soils are susceptible to erosion (especially on south facing aspects). When disturbed by harvesting activity, soils in these slope and aspect conditions can be subject to erosion levels in excess of standards of the Forest Plan. Most of the stands for all alternatives are on slopes less than 15 percent. Erosion hazard for each of the soils are in the soils table in the appendix of the EA.

Desired Future Condition for Soils

The purpose of this project is to change existing conditions to conditions that more closely resemble the desired future condition by maintaining healthy and functioning oak/hickory forest communities in all their successional stages. In the past, fire maintained some of these ecosystems. Prior to European settlement, a

mantle of loess of two to five feet blanketed northern Missouri, which was extremely productive and provided the substrate for a rich and diverse floral community above ground and an even richer and more diverse floral and faunal community below ground. (Scrivner 1966) Past land use has resulted in the erosion of most of this mantle.

The desired future condition includes restoration of soil productivity potential. It is unrealistic and impossible however to duplicate geologic processes and restore the soil to pre-settlement conditions in the foreseeable future. Soil formation is a long, time-consuming process, which could take hundreds to several thousand years to return to that previous condition. (Buol, Hole, McCracken, Southard 1997) However, the present project, future projects, other similar project proposals on the Forest, and the mitigation measures employed can be expected to reduce soil erosion in the short term and continue the soil formation.

Direct and Indirect Effects on Soils by Alternative

The stands that are proposed for treatment in this project cover a wide range of landscapes throughout the Cedar Creek Unit Area. The soils that would be affected by the proposed alternative are identified and characterized in table in Appendix E of this document.

Many of the treatments in Alternatives 2 and 3 involve uneven-aged harvest of trees at different intensities. Thinning and tree harvest would leave remaining trees to occupy sites and maintain water budgets and nutrient cycles at current levels.

General Effects of Soil Erosion

Because soil is eroded off the surface horizon, erosion results in a loss of nutrients for forest productivity. (Pritchett 1987) It also results in a loss of biodiversity of thousands of species of soil microorganisms numbering in the millions of total organisms, which are lost to the site where the erosion was taking place. (Pierzynski, Sims, Vance, 2000) In addition, erosion also results in a loss of carbon, which was sequestered in the surface horizon. (Boyle, 2002)

Erosion Hazard is rated according to risk of erosion on forestland where normal practices are used in managing and harvesting trees. A rating of **slight** indicates soil loss is not important concern; a **moderate** rating indicates that some attention to soil loss is required; and a **severe** rating indicates that intensive treatments (such as seeding and mulching disturbed areas, water bars, etc.) or special equipment and method of operation are required to minimize erosion. Potential erosion hazard is based mainly on slope and erodability as well as on soil depth. Soils in the ELT's Number 51 – 53 and 57 are most susceptible to erosion as these typically occur on moderately steep, to steep slope gradients.

Forest soil interpretations for Callaway County have rated soil units for potential of damage. Soil erosion potentials in the project area range from low to medium. Armstrong, Calwoods, Cedargap, Gorin, Haymond, Keswick (0 – 8 percent), Landes, Lindley (0 – 13 percent), Mexico, and Weller (0 – 8 percent) have low erosion hazards. Gasconade/Goss/Rock Outcrop complex, Keswick (9 percent or above), Lindley (14 percent or above), Weller (9 percent or above), and Bethesda/Dumps complex are given a medium erosion hazard rating. No soil units in the project areas were given a high erosion hazard rating.

There are various prediction models for soil erosion and more specifically rill and sheet erosion. The WEPP model has recently been used to predict erosion levels from harvesting activities. Use of the specifications in this EA would reduce all these erosion levels significantly and within Forest guidelines.

The main concern for soil productivity concerning harvesting equipment is the soil compaction potential. Forest soil interpretations for Callaway County have rated all soil units high for soil compaction potential.

Potential of Damage to Soil From Fire is rated according to the degree to which soil characteristics are reduced in productive capacity from fire. The ratings (low, moderate, high) are made on the basis of texture, amount of coarse fragments, slope, and surface soil. Forest soil interpretations for Callaway County have rated soil units for potential of damage from fire. Most of the soils associated with this proposal have a rating of low to moderate potential. The only soil unit having a high rating is the Bethesda silty clay loam/Dumps complex. Keswick loam and Weller silt loam (located on sideslopes where erosion has removed some of the original surface layer) are the primary soil units having a moderate potential of damage from fire. Nearly all other soil units on the project areas have a low potential.

Suitability for Pond Development is rated according to the degree soil characteristics affect or have limitations for the pond reservoir areas. The limitations are considered slight if soil properties and site features are generally favorable for this use and limitations are minor or easily overcome. Limitations are considered moderate if soil properties or site features are not favorable for this use and special planning or design, or maintenance is needed to overcome or minimize the limitations. Limitations are considered severe if soil properties or site features are so unfavorable that special design, significant increase in construction costs, and possibly increased maintenance are required. Soils best suited to this have low seepage potential in the top 60 inches. The seepage potential is determined by permeability in the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect storage capacity of the reservoir areas.

Suitability for Timber Management Soil surface disturbance is one of the effects of the activities proposed. Management activities associated with timber harvest and regeneration in Alternatives 2 & 3 would cause some soil disturbance. Potential exists for soil compaction, soil puddling, soil displacement and soil surface erosion, as a result of heavy equipment operation on sites where management activities would occur. There would be little loss of landform from road reconstruction as these areas have already been disturbed. Soil surface disturbance is important because it has an impact on soil quality, maintenance, and sustainability. This disturbance would be expected to occur on or adjacent to skid trails and landings both during and after the activities take place. The Standards and Guides of the Forest Plan are designed to minimize the amount of disturbance from management activities. Assessment of proposed activities on specific sites would determine if the degree and extent of soil disturbance would cause appreciable change in soil properties to be considered detrimental to the long-term productivity of the land. Determination of effects is based on available research, the recently completed soil surveys for Callaway and Boone counties, and professional judgment. Adherence to Forest Plan (FP) Standards and Guidelines (S&G) and site-specific mitigation measures that follow would result in no appreciable changes in the inherent long-term productivity of the land.

Soil limitations for the stands in the proposed alternatives range from slight to severe. Slope percentage and depth to water table are dominant factors, which impose limitations. Erosion hazards are slight to moderate in most stands although the hazard can be rated as severe when slope percentages increase. The potential of damage to soil from fire ranges from slight to moderate for most soils in most stands though the hazard can become severe on steep slopes.

Alternatives were evaluated to assess whether implementation of the proposed project would result in any detrimental or beneficial effects to the soil resource. Harvesting, prescribed burning, timber stand improvement, and wildlife projects can affect soil productivity and soil quality. Alternatives can be compared based on the relative effects of soil disturbance.

The Forest Service Internet-based interface to the Water Erosion Prediction Model (FSWEPP; Elliot et al 2000) was used as part of this analysis. Climate was simulated for ten years at Jefferson City, Missouri to obtain a range of wet and dry conditions. Erosion and sedimentation predictions must be evaluated with a full understanding of the uncertainties.

“At best, any predicted runoff or erosion value, by any model, will be within only plus or minus 50 percent of the true value. Erosion rates are highly variable, and most models can only predict a single value. Replicated research has shown that observed values vary widely for identical plots, or the same plot from year to year (Elliot et al 1994; Elliot et al 1995; Tysdale et al 1999) Also, spatial variability and variability of soil properties add to the complexity of erosion prediction.” (Robichaud 1996) (Elliot et al 2000) (excerpted from Disturbed WEPP (Draft 2/2000)WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery (William J. Elliot, David E. Hall, Dayna L. Scheele. U.S.D.A. Forest Service Rocky Mountain Research Station and San Dimas Technology and Development Center, February 2000) online from <http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html>

FSWEPP provides relative versus absolute results to estimate and compare the magnitude of effects of alternatives. The analysis allows a comparison of alternatives but does not predict the effects for a specific stand. The outputs are given in tons per acre. One ton of soil loss is approximately equal in weight to a uniform depth of 0.007 inches of soil over one acre. (Troeh et al.1991)

Alternative 1: No Action Alternative

No new management activities would take place, or any associated activities, with this alternative. Therefore, no management related appreciable changes in productivity of the land would occur. Soils would be impacted by regular maintenance and use of roads as well as planned and ongoing natural resource management activities. In the absence of wildfire, current runoff and erosion pattern would be maintained. An upland erosion rate of less than one ton per acre per year is predicted by FSWEPP for stands on steep slopes in the absence of fire. Natural processes and functions would continue to occur as dead material decomposes. Actual soil organic matter may increase with an accompanying increase in microorganisms and fungi. Since there is no harvest, no carbon would be removed from the forest. Dead and dying trees would decay with carbon released to the atmosphere. Management activities in and adjacent to the project areas already planned would be carried out.

Under this alternative, 475 acres of treatments designed to maintain open/semi-open habitat would be employed. These treatments would involve a combination of burning, mechanical treatment, and grazing. This is 75 acres more than in Alternative 2 or 3. The additional acres are in those stands in Alternative 2 and 3 scheduled for planting native hardwood or allowing semi-open areas to grow into wooded vegetation. Pond maintenance would also be performed as needed.

Under this alternative, fuels would not be reduced nor would biomass be removed through 250 acres of prescribed burning or through 460 acres of uneven-aged management as identified in the proposed action. Fire suppression has resulted in increased fuel loading and possible loss of savanna and glade environments

present during pre-settlement times. (Heikens 1999) Wildfires that could occur under conditions of increased fuel loading would be expected to burn at a higher intensity and over a larger area than would have occurred if fires had burned at historical fire frequencies. The probability of stand replacement wildfires could be expected to increase in the absence of fuel reduction through silvicultural treatments in this proposal. The stands in other alternatives where wildfire does not occur would maintain current runoff and erosion pattern. An upland erosion rate of less than one Tons/Acre/Year is expected for stands on steeper slopes and near water if fire is excluded. Fire exclusion could result in accumulation of hazardous amounts of fuels.

Lack of fuel reduction could result in stand replacement wildfires and increase the probability and levels of erosion and sedimentation from lands where these fires occur. FSWEPP modeling indicates that a high severity fire for conditions similar to those described above would produce a ten to fifteen fold increase in erosion (depending on slope) and a like increase in sedimentation. Predicted erosion and sediment quantities are listed in the Appendix E. According to the model, wildfire produces many times more erosion than do prescribed burns.

Wildfire control would more likely involve bulldozer-constructed firelines. Overland flow in firelines would further erode soils and be a source of sediment. As an example, a twelve foot wildfire control line constructed by dozer along a 4,910 foot perimeter of the average 25 acre stand in Middle River area (the area affected by the wildfire may well be far above 25 acres) would total approximately 1.35 acres (about 5.4 percent of a 25 acres steep stand could become an erosive fireline in the event of a wildfire). Predicted erosion rates for various scenarios are given in Appendix E.

Lack of watershed health improvements in Alternative 1 would not improve the existing soil resource concerns such as soil displacement on the Forest Service road, compaction, and soil movement at wooded draws.

Effects Common for Alternatives 2 & 3

The direct and indirect effects of the action alternatives on soils would be the same, varying by the amount of the activity that would take place with each alternative. Any cutting would be by stem removal only. This leaves the nutrient rich branches and leaves to be recycled, whether through decomposition or volatilized from burning.

All action alternatives would remove carbon from the forest by cutting and prescribed burning. The differences between the alternatives lie in the type of harvest activity, the volume removed, remaining stocking levels, and the reforestation activities, which are planned. All alternatives would remove a large amount of carbon from the forest, mostly from salvage material but also some live healthy material.

A direct effect of timber cutting upon the area's soil and water resources would result from the temporary road usage and road reconstruction needed to access the stands. In Alternative 2 & 3, some road maintenance and/or reconstruction would be required to provide access to project areas (several of these roads already exist). Soil would be exposed, excavated and displaced during harvest operations. Forest experience with harvesting on similar soils and slopes show some roads re-vegetated within one year after all sale activities have ceased.

During use, roads would intercept and channel overland water flow to dips. This water normally carries suspended sediments from the road prism into undisturbed filter zones below the road where it is filtered through the forest floor. During high intensity rainfall when overland flow exceeds the infiltration rate of the soil, these sediments could reach the ephemeral and intermittent drainages. The primary areas of concern would be areas which have soils with perched water tables, areas with slopes exceeding 35%, and areas adjacent or crossing waterways.

The treatments under Alternatives 2 & 3 can be broken down into four main emphasis groups: wildlife habitat enhancement, watershed health, recreation management, and associated and connected actions.

Wildlife Habitat Enhancement

A1a: Open/Semi Open Land

Alternative 2: This treatment over 400 acres would be accomplished through a combination of mechanical means, grazing, and prescribed burning.

The effects of prescribed burning on soil erosion and nutrient loss are related to the severity of the burn. These effects are complex and depend on a host of factors but certain generalizations seem relatively consistent. Burning has its most pronounced effect on the forest floor where carbon I, nitrogen (N) and sulfur (S) are volatilized and calcium (Ca), magnesium (Mg), potassium (K), and phosphorus (P), and other elements are left as ash. The ash is leached by rains into the mineral soil, which increases its' base saturation and pH. (Alban 1977) Increased nutrient availability at higher pH may result in positive plant responses following fire (Van Lear and Kapeluck (1989). These results coincide with results from a variety of other reviews and studies. (DeBano 1998) (Luckow, 2000a, 2000b, 2000c) (Godsey 1988) (Amelon, 1991) (Schlesinger 1997) Erosion can increase as a result of prescribed fire. The highest probability of erosion would occur after a prescribed fire on steeper slopes. WEPP model runs indicate that the erosion levels are generally within soil tolerance guidelines (set up by the NRCS and the Agriculture Research Service) and are much lower than erosion and sedimentation levels after a high severity stand replacement fire. Even if a wildfire occurred in areas treated with prescribed burning, these areas would experience less erosion damage after the fire, wildfires would not burn as hot, and trees may be left with a portion of their foliage. (Hayman Fire Case Study Analysis, cited within E-Forester published by SAF, February 24, 2003)

Alternative 3: Similar effects to Alternative 2, but with 430 acres remaining open.

A1b: Maintain Open-Semi Open Habitat – Plant Native Hardwoods and/or Reduce Prescribed Burning in Open/Semi Open Habitat

Alternative 2: Little ground disturbing activity is expected from planting 45 acres of native hardwoods or allowing 30 acres to regenerate naturally. Natural functions and processes are expected to occur.

Alternative 3: Similar to Alternative 2, but only 8 acres would be planted to hardwoods.

A2: Designate habitat for wildlife species utilizing old growth

Alternative 2: 190 acres of designating woodland habitat for wildlife species would be accomplished through old growth management under this alternative. No ground disturbing activity is expected from old growth management and natural functions and processes is expected to occur.

Alternative 3: The addition of approximately 10 acres from stand changes in Compartment 9 keeps this alternative similar in effects to Alternative 2.

A3a: Provide Woodland Habitat in Oak Sawtimber in 20 – 30 % forbs, grasses, and shrub ground cover – Uneven-aged Management

Alternative 2: This alternative would increase areas of soil disturbance. Some of these areas would experience soil compaction by harvesting equipment. Most of the soils are moderately to well suited to harvesting equipment (check soil characteristics table in the appendix). Erosion and sedimentation could occur from these impacts. Erosion and compaction could also occur at unacceptable levels during periods of wet soil conditions and on soils with perched water tables typically occurring from November to May.

Uneven-aged management would retain leave trees to occupy sites and to maintain current water budgets and nutrient cycles.

This activity is taking place on a range of soils. Nearly every stand where uneven-aged management would be proposed are on sites where a portion of the stand location occur over soils with perched water tables. Soil compaction is high for all stands though skeletal soils will have some armoring to counteract this. Forest productivity is low on all sites. Soil erosion is rated as low to medium.

This activity is taking place on a range of ELT's. The uneven-aged management taking place on ELT 52 and 53 are most susceptible to erosion although other ELT's (55) can occur on moderately steep slope gradients and on gentler slopes.

Most of the stands for this activity are located on gentle slopes. About eight stands (Compartment 9: Stand Nos. 7, 27, 30, 35, 45, 46, 53; Compartment 10: Stand Nos. 3) are located on moderate slopes (15 – 34 percent slopes) and erosion potential will be higher on these sites.

Alternative 3: Effects would be the same to Alternative 2.

A3b: Provide Woodland Habitat in Oak Sawtimber in 20 – 30 % forbs, grasses, and shrub ground cover – Prescribed burning.

Alternative 2: The effects of prescribed burning on soil erosion and nutrient loss are related to the severity of the burn. These effects are complex and depend on a host of factors but certain generalizations seem relatively consistent. Burning has its most pronounced effect on the forest floor where carbon I, nitrogen (N), and sulfur (S) are volatilized and calcium (Ca), magnesium (Mg), potassium (K), and phosphorus (P), and other elements are left as ash. The ash is leached by rains into the mineral soil, which increases its' base saturation and pH. (Alban 1977) Increased nutrient availability at higher pH may result in positive plant responses following fire. (Van Lear and Kapeluck

(1989). These coincide with results from a variety of other reviews and studies. (DeBano 1998) (Luckow, 2000a, 2000b, 2000c) (Godsey 1988) (Amelon 1991) (Schlesinger 1997) Erosion can increase as a result of prescribed fire, but WEPP model runs indicate that the erosion levels are generally within soil tolerance guidelines (set up by the NRCS and the ARS) and are much lower than erosion and sedimentation levels after a high severity stand replacement fire. Even if a wildfire occurred in areas treated with thinning and/or prescribed burn, these areas would experience less erosion damage after the fire, wildfires would not burn as hot, and trees may be left with a portion of their foliage. (Hayman Fire Case Study Analysis, cited within E-Forester published by SAF, February 24, 2003) Low intensity prescribed fire used alone or in combination with uneven-aged management would not be expected to have a major affect on the quantity of water flow, nutrient budgets, or soil quality.

Alternative 3: Same as Alternative 2

A4: Provide Temporary Woodland Habitat in the 0 – 9 Age Class

Alternative 2: Uneven-aged management and prescribed burning are expected to provide this habitat for 69 acres. The impacts would be similar to those addressed above.

Alternative 3: The impacts would be the same to those addressed above.

A5: Provide Diverse Amphibian Habitat – Breach and lower pond

Alternative 2: This action would have a long-term benefit for wildlife and watershed health. There is the possibility of erosion and sedimentation during the activity and strict attention to the BMP's and Standards and Guides is necessary to keep potential to a minimum.

Alternative 3: No change from Alternative 2.

Watershed Health

B1: Fencing to exclude livestock

Alternative 2: Fencing to exclude livestock from wooded areas and hardening drainage crossings would be expected to reduce soil compaction, reduce soil erosion, and reduce possible sedimentation.

Alternative 3: No change from Alternative 2.

B2: Pond reconstruction

Alternative 2: Pond reconstruction could be expected to result in minimal short-term erosion and sediment increase (at the time the treatments are implemented) and a long-term erosion and sediment decrease. Pond construction would take place in Compartment 9, Stand No. 50 which is located over Keswick loam which has moderate to severe limitations for pond development due to slope.

Alternative 3: No change from Alternative 2.

B3: Reconstruct Forest Road 1686 to improve drainage crossing

Alternative 2: Roads generally contribute the greatest amount of erosion and sediment in any forest system. The Forest –wide Road Analysis included simulations from the WEPP models that model erosion potentials for various road conditions for the Cedar Creek Unit area. Reconstruction, re-conditioning, spot treating, and road closures could be expected to result in minimal short-term erosion and sediment increase (at the time the treatments are implemented) and a long-term erosion and sediment decrease.

Alternative 3: No change from Alternative 2.

B4: Improved Pasture Access with Gravel

Alternative 2: This activity would serve to reduce erosion and may reduce sedimentation.

Alternative 3: No change from Alternative 2.

B5: Close non-system road

Alternative 2: Non-system roads have been used for limited illegal ATV use. This has resulted in the potential for some erosion in the past. In the long run, closing this road can be expected to result in reduced erosion in the future, especially if the road closing includes erosion control measures.

Alternative 3: No change from Alternative 2.

B6: Construct erosion control structure

Alternative 2: Constructing erosion control structures can be expected to reduce erosion and sedimentation if properly constructed and maintained.

Alternative 3: No change from Alternative 2.

B7: Close wells

Alternative 2: No or minimal ground disturbing activity is expected from closing 2 wells and natural functions and processes are expected to occur.

Alternative 3: No change from Alternative 2.

B8: Maintain Open-Semi Open Habitat –Pond Maintenance

Alternative 2: No or minimal ground disturbing activity is expected from mowing and natural functions and processes are expected to occur

Alternative 3: No change from Alternative 2

Recreation Management

C1: Improve parking areas at 5 sites

Alternative 2: No or minimal ground disturbing activity is expected from improving parking lots with gravel and natural functions and processes are expected to occur.

Alternative 3: No change from Alternative 2.

C2: Improve interpretive signing – 1 sign

Alternative 2: Minimal ground disturbing activity is expected from installing a sign.

Alternative 3: No change from Alternative 2.

C3: Improve dispersed access – 1 gate

Alternative 2: Minimal ground disturbing activity is expected from installing a gate and natural functions and processes are expected to occur

Alternative 3: No change from Alternative 2.

Associated and Connected Actions**D1: Fire line construction**

Alternative 2: Erosion from skid trails, landings, and forest roads on ridge tops is similar to erosion from a fire line. The FSWEPP model was run using skid trails on various slopes and soils. A fuller analysis for various scenarios is given in the Appendix. Silt loams (both skeletal and non-skeletal) and a variety of slopes were modeled. The highest probability of erosion would occur after a prescribed fire on steeper slopes.

Alternative 3: No change from Alternative 2.

D2: Reduce non-native invasive noxious weeds – Use herbicide spot treatments.

Alternative 2: Herbicide spot treatments on noxious weeds are likely to come in contact with the soils and be subjected to any of a variety of processes in the soil. The interactions of herbicide and soil are transport/transfer, decomposition, persistence/residues.

Transfer/transport mechanisms include adsorption, absorption, erosion, leaching, and volatility. Herbicides adsorbed on soil particles (especially fine textured soils) are unavailable for leaching or degradation but are in a passive state until desorbed. Most of the soil mapping units have a low erosion potential which increases with increasing slope but can be transported to nearby streams by this mechanism. Leaching is more likely on coarse textured soils in wet soil conditions but can be limited by slow infiltration in the subsurface horizons and perched water tables. Volatility is a transport/transfer mechanism influenced more by the herbicide characteristics than the soil.

Decomposition is the breakdown of a herbicide and can take place by photochemical decompositions, chemical decompositions, or microbial decomposition. Photochemical decomposition depends on herbicide susceptibility, light energy supplied, and UV light absorption capacity of the molecule. Chemical decomposition can take place by oxidation-reduction reactions, hydrolysis, salt formation, and chemical complexes. Microbial decomposition occurs as microbes use organic herbicides for nutrients and energy and enzymatic reactions. The enzyme is secreted or the herbicide is absorbed by the microbe. This decomposition is probably the main way that herbicides are degraded in the soil.

Persistence refers to the length of time a herbicide remains active in the soil and is classified by the half-life. Herbicide residues can be minimized by using the lowest dose that will obtain the desired control.

The LRMP (IV-23) states that “On Riverwash, Gasconade, Alluvial lands-mixed, Rockland, Midco, Elsah, Syenite, Opequon and Ramsey soils, and the Granite Glades, application of pesticides not registered for watercourse bank or instream use shall be by individual stem application.” The stands proposed for tree planting in Compartment 9 contain some Gasconade soil. Glyphosate was identified for spot application for the hardwood tree planting in these areas. The formulation registered for aquatic uses would be utilized in this location. More information on proposed herbicide use is found in Chapter 4. In stands 47 and 56, where some spot treatment of noxious weeds is proposed, some Gasconade soil is also found. However, these are upland fields and no treatment near drainages are proposed.

Registered herbicides for noxious weed control, such as glyphosate and triclopyr, should have minimal effects on the soil resources because they would be applied in spot treatments on specific plants, affecting the soil only in a small area. Based on the Risk Assessment Report that this document is tiered to, there is “very little information suggesting that glyphosate will be harmful to soil microorganisms under field conditions and a substantial body of information indicating that glyphosate is likely to enhance or have no effect on soil microorganisms.” Triclopyr is active in the soil and is absorbed by plant roots. It is adsorbed by clay particles and organic matter particles in soil. Microorganisms degrade triclopyr rapidly; the average half-life in soil is 46 days. It degrades more rapidly under warm, moist conditions. It is slightly toxic to practically non-toxic to soil microorganisms. With no broadcast spraying of herbicides, the possibility of runoff would be reduced to other vegetation. Label directions for the herbicide would be followed, utilizing weather condition and ground condition recommendations on the label.

Alternative 3: No change from Alternative 2.

D3: Reduce competition in hardwood plantings. Use herbicide spot treatments.

Alternative 2: See Alternative 2 above.

Alternative 3: No change from Alternative 2, except fewer spots will be treated since fewer acres are being planted to trees.

Cumulative Effects on Soil

Erosion for Alternatives 2 & 3 is not expected to exceed Forest Plan Standards and Guides or Region 9 Soil Quality Monitoring Interim Directive No. R9RO 2509.18-2002-1 for any single activity in the proposed

action or other alternatives. Many stands in all alternatives have more than one activity planned (i.e. harvesting and prescribed burning). The cumulative effect of more than one activity could result in erosion exceeding soil tolerances for the soils in these areas. Strict adherence to the Forest Plan Standards and Guides and to the mitigation measures in this EA will be critical to keep soil erosion and sedimentation to within Forest standards.

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful regarding the soil resources.

Most of the soils in the assessment developed in loess – a loamy material formed by glaciers and transported by wind – and in residuum from cherty limestone, dolomite, and sandstone. (USDA Forest Service, MTNF 2001) Loess is a loamy, wind deposited material, most of which was deposited during glacial periods. In the assessment area, the mantle of loess varied in thickness from two and one-half to five feet, increasing in areas adjacent to the Missouri River where original loess deposits approached 20 feet. Soil conditions were described as ranging from “barrens and prairies..., the soils poor and covered with grass, ...” to “the soil rich with a heavy growth of trees.” (Nigh 1992) (Schoolcraft 1821) In many areas, up to 90 percent of this mantle has been eroded away. (Scrivner, 1966) Aside from erosion occurring from geologic and other natural processes, erosion is a function of past land use. Clearcutting of pines and hardwoods, which began near the turn of the century and continued through the 20’s and 30’s was followed by farming, annual burning and intense over-grazing. When the timber supplies were exhausted, local people turned to farming. Those attempting to pasture the cutover lands had to contend with resprouting of hardwoods. Intensive sheep and goat grazing and fire were the primary means of controlling hardwood regrowth and restoring grass cover. Repeat fires exposed the thin soils to erosion, which robbed the hillsides of the nutrients essential for both herbaceous understory (forbs, grasses, and shrubs), and tree growth. (Cunningham and Hauser 1992) With the loss of ground or canopy cover, erosion of the loess mantle continued. (Hammer, personal communication) (Jacobson and Primm 1994) During this period of settlement, it was estimated that six to eight inches of surface soil had been washed away. (Law 1992) (USDA Forest Service 1952) From the end of the 1930’s to the end of the 1950’s, public land managers became concerned with healing the eroding lands, ending annual woods burning, and establishing young forests. Even so, it was 1969 before the period of over-grazing by free roaming livestock ended. (Law 1992) (Keefe 1987) As a result, many of the soils in the assessment area have shallower surface horizons, lower available water holding capacities, and relatively lower soil fertility than during pre-European settlement conditions.

On Forest Service lands, past activities include timber harvesting and associated road building, landings, haul roads, grazing, mining and wildlife openings construction and maintenance. The past activities of timber harvesting and wildlife openings as well as grazing on National Forest system lands have had no long-term negative impact on the soil productivity with the mitigation measures applied. There is no evidence of accelerated erosion in the uplands. The invasion of Eastern red cedar in openlands and along side drainages have deterred effective establishment of deep-rooted grasses and forbs and allowed some soil movement to occur. Areas where there have been timber harvests in the past have re-vegetated and there is no bare soil exposed in the closed cutting units. One of the roads in the Project Area would be reconstructed. There are a number of unclassified non-system roads that are present in some of the areas that could be used for temporary haul roads. This would reduce the amount of new roads needed and would reduce the amount of associated sediment movement.

On private lands, past activities have included conversion of forested land to pastures consisting primarily of fescue monocultures, timber harvest, and road building. During the conversion process to pastures there was an increase in the sedimentation to streams and creeks and their tributaries. Most of the riparian areas consist of private lands and surrounding uplands of perennial streams of the project area. In areas where the landowners left an adequate woody corridor and/or sufficient herbaceous plants along the perennial streams, the streambanks along the creek appear fairly stable. Other areas without an adequate woody corridor or herbaceous plants along the streams exhibit signs of accelerated bank erosion. The majority of the land clearing has been the conversion from hardwoods to non-native, cool-season grasses. Removing the hardwoods in the uplands and along the stream channel had a major impact on the stability of the channel. It is not known how much additional land would be cleared and what the associated sedimentation of the stream would be as a result of activities on private lands, though it should be similar to the recent past.

Past land activities have also included employment of chemical pesticides and herbicides. The majority of this has occurred on private lands in both agricultural and forested areas. Use of pesticides on National Forest lands has been minimal in comparison to private use. Pesticide use in the National Forest has been employed to deal with noxious weeds, un-wanted vegetation in lakes, and insects and poison ivy in some recreation sites. There is no evidence that these chemicals have leached through the soil into the groundwater or entered streams via surface runoff. Adherence to Standards and Guides and strict contract administration have resulted in protection of the watershed resource while using chemical controls in resource management on the Forest.

The management activities proposed under this environmental analysis would result in some soil disturbance. This disturbance would be a result of temporary roads, fireline construction, logging, and prescribed burning. The road reconstruction and firelines that are on steeper slopes and/or cross the intermittent or ephemeral drainages would be the primary source of sediment in the unlikely event that sedimentation may occur. The sediment increase would be highest during construction and would be reduced as the road become stable and vegetated. In the long term, this road reconstruction would improve the crossings and reduce any potential future erosion. Closing and obliteration of any temporary roads is critical in bringing the erosion rate down to pre-harvest and pre-construction levels. Prescribed grazing each year, from mid-April through mid-October, within the capacity of the land and within Forest Plan Standards and Guides, would provide sufficient herbaceous cover to protect openland soil resources. Timber harvesting will have minimal impact on the sedimentation of the streams or drainages.

Watershed health activities proposed in Alternatives 2 and 3 would reduce sediment movement, compaction and erosion. Overall soil and watershed health of the Middle River Project Area would be improved with these activities. Alternative 1 would allow negative impacts on soil resources and watersheds to continue.

In the stands that would have uneven-aged management, some minor soil erosion would be expected to occur. The hardwood slash from harvesting acts as a protective cover for the soils and could help mitigate compaction if used during harvesting. The stands that would have prescribed fire would have potential for soil erosion. This erosion would result from the construction of firelines and possibly from burned units. The increase in erosion from the burn unit would be a direct result from fire intensity, increasing slope, and soil texture. Burning with a cooler fire results in minimal soil erosion, due to the protective duff layer that would still be present. If there would be an increase in soil erosion, it would usually be of very short duration. On the stands that would have various selection harvests (seed tree, shelterwood, thinning, sanitation cuts, uneven-aged management, overstory removal, etc.), some minor soil erosion would be

expected to occur. In these stands there would be enough ground cover or slash to protect any bare mineral soil.

Losses of soil nutrient capital via erosion would be offset by precipitation and other atmospheric inputs occurring over time following the activities of the proposed action (Peterson, 1982) (Weaver and Brown, 1978). The population of soil organisms would be reduced in the short term where soil erosion takes place but would increase over time eventually to pre-harvest levels if erosion keeps to minimal levels. Erosion and the associated decomposition of soil organic matter is difficult to estimate because this pool of organic carbon in the process of erosion is highly variable and a “moving target”. Eroded organic material mineralizes to carbon dioxide, methane, and nitrous oxide at rates far in excess of the non-eroded counterparts due to loss of physical protection and the changes in environmental conditions caused by dislodgement and transport. (Boyle 2002) The flux of carbon through forest systems is highly variable such that turnover of soil carbon lost through erosion could be replenished in time periods ranging from 2 – 100 years. (Fisher and Binkley 2000)

Irreversible or Irretrievable Commitment on Resources:

None of the alternatives would have an irreversible or irretrievable effect on the soil resources.

WATERSHED

Existing Conditions

In the revised edition of “The Fishes of Missouri”, dated 1997, William Pflieger describes four aquatic faunal regions in Missouri: the Prairie, Ozark, Lowland, and Big River. The geographic location of the Middle River Project Area places it in the extreme southern portion of the Prairie Region and bordered to the south by the Big River Region and to the east by that small part of the Ozark Region found north of the Missouri River. At its closest point, the Middle River Project is 8 air miles north of the Missouri River. The MTNF’s Aquatic Ecological Classification System (AECS) describes the Middle River as a RA36A100; which means known intermittent, seasonally dry, known warm water. The Missouri Department of Natural Resources (DNR) describes the Middle River as a perennial stream from the mouth, 8.5 miles north to Section 4, T45N, R9W. Above this, Middle River is classed as an intermittent stream with permanent pools. This means the Middle River, which has about 1.5 miles within the project area, is a stream which may cease flow in dry periods, but maintains permanent pools that can support aquatic life. Walk in access, utilized by both horseback and foot traffic, to the northeastern portion of the Project Area crosses the Middle River, but does not allow vehicle access to the area. Some illegal ATV usage has occurred at this crossing.

The watershed of the lower portion of the project area (Compartment 10) drains into Prime Creek, a tributary of Middle River, with only intermittent water. Prime Creek flows into Middle River two miles south of the Project area. There are no waters within the project area listed on the 1998 State of Missouri 303(d) list of polluted waters. According to Priscilla Stotts, Missouri Stream Team Coordinator, Middle River is not one of the streams currently being monitored by Missouri Stream Team volunteers. Therefore, there are no chemical or biological parameters for Middle River in DNR’s Stream Team database.

Within the Middle River Project Area, there are 10 ponds and 1 small lake. Seven of these have been stocked and managed for game fish, including bluegill, channel catfish, and Largemouth Bass. The ponds are mostly man-made; seven of them are fenced with watering tanks for cattle usage. Most are less than 1-acre. The small lake was formed from a previous clay-mining operation in the late 1980s and has been reclaimed by planting trees and seeding grasses along its banks.

Sediment increases in all streams during storm-runoff conditions, largely coming from natural sources in the watershed and channel bank erosion. The sediment increase can also result from unstabilized areas of ground disturbance. No areas of concern on federal lands were found. Several small drainage crossings were identified that were accessible by cattle for short periods of time from mid-April through mid-October each year. Forest Road 1686 can be muddy and is impacted from several small drainage crossings. The floodplain areas, within National Forest ownership, along the Middle River are in fairly good condition. Regeneration to bottomland hardwoods has occurred naturally, except for a bottomland field in fescue sod.

Within the project boundary, private land borders the eastern side of Middle River. The riparian areas on private land are in moderate condition, depending on land management practices and presence or absence of a wood corridor along the stream. The lack of forest riparian zones along Middle River, due to the conversion of forest areas to pasture and crop lands has contributed to the general health and stability of the stream.

Precipitation

Precipitation over the Middle River Project Area averages 38 inches per year. Snowfall occurs within the area frequently during the months of December through March. Individual snowfall events seldom amount to more than a few inches and usually only persist for a few days. Ice storms occur infrequently.

Extreme precipitation events could lead to floods that can have an effect upon the area's natural resources. Floods could increase nutrient, trace metal, and organic chemical concentrations in streams and deposit gravel in streambeds. Flash floods can deposit large amounts of sediment on crop and pastureland. Lack of precipitation in the late summer season can lead to drought stress. Period of drought can lead to mortality in mature forest stands, particularly the black and red oaks. Drought can contribute to deterioration of pastures and affect low water quality in streams and ponds affecting aquatic habitat and recreational fishing.

Direct and Indirect Effects on Watersheds by Alternative

The alternatives were evaluated to determine if implementation would result in any detrimental effects to the water quality. The majority of the potential impacts on water quality would be due to erosion, reduction in sedimentation in drainages due to proposed fencing to minimize livestock access, hardened crossings for livestock rotation between pastures, road reconstruction, timber harvesting practices, prescribed burns and fireline construction.

Alternative 1

There would be no direct impacts to the water resources from project activities since no new management activities would occur. Current runoff and erosion patterns would be maintained. Drainages would not be improved by fencing to minimize livestock access, with hardened livestock crossings, or road reconstruction.

Indirectly, with no riparian planting adjacent to Middle River, the stream banks would still have some instability and runoff would not be filtered, therefore keeping current erosion potential near the river course. Shade would not be provided over time because no trees would be planted.

Alternative 2 and 3

The direct and indirect effects of the action alternatives on water quality would be similar, varying by the amount of the activity that would take place with each alternative. By Forest Plan definition, no riparian areas would be affected. Timber harvesting, fireline construction, erosion control improvements, and road reconstruction would have a short-term negative effect during project implementation such as localized soil disturbance and compaction. This could increase runoff and turbidity in streams directly adjacent to and downstream of disturbed areas with the Middle River Project Area. However, long-term direct effects would be positive from enhanced herbaceous vegetation in the wooded areas and burned areas. Road reconstruction would also help alleviate contributions to downstream turbidity as well as improve water quality in the Project Area.

Timber harvesting may increase sedimentation where the forest road is reconstructed, if there is use and creation of skid trails, and if there is a loss of vegetation on hillsides and along drainages. The effects of these activities can be minimized through mitigation measures during the activities and revegetation following the completion of activities as needed. The FY2002 Monitoring and Evaluation Report indicate that the Standards and Guidelines for maintenance of water quality on timber management projects are providing protection of the water resources in the area.

The riparian area plantings would have a positive long-term effect on the Middle River by increasing bank stability, slow runoff, decreasing the erosion potential near the river course, and in time provide shade to the river, thereby decreasing stream temperatures. The activity of planting would have no long-term negative effects on water quality or quantity.

The proposed prescribed burns would not have a negative impact on water quality. At low intensity, landscape prescribed burning removes vegetation in a patchy manner.

The closing of non-system roads/trails would in time result in improved water quality of Middle River.

Projects proposed to fence livestock from wooded areas and harden crossings would improve the overall water quality and reduce surface runoff. See also the discussion in the Soils section of this document.

Constructing erosion control structures, either with rock or planting native vegetation, would reduce erosion by trapping sediment and allowing additional vegetation to establish in the drainage channels further down slope. These projects would improve the overall water quality into the future. Closing of existing open wells would protect ground water from possible pollutants.

Pond reconstruction and installation of a livestock watering tank, with the associated fencing to exclude livestock, would produce a higher quality watering source for wildlife and livestock, as well as a potential recreational fisheries.

The spot application of herbicides on noxious weeds and fescue sod should have minimal effect on water quality of the area. There will be no broadcast spreading of herbicide and the hand treatment of individual

plants will reduce the possibility of runoff into any nearby water systems as well as leaching from contaminated soil and/or accidental spills into the water systems.

Effects to aquatic life are described in the fisheries section of this document.

Cumulative Effects on Watershed

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful regarding the watershed and water quality.

Just a small portion of National Forest lands fall within the Middle River watershed, so long term cumulative effects would be influenced more from private land than existing federal lands. Proposed logging operations within National Forest boundaries could increase short-term sedimentation in the watersheds, but the effects from logging, including the use of temporary skid trails, would be minimized by mitigation measures designed to protect the integrity of the watersheds. Cumulative effect, with proper mitigation measures, on the watersheds would be negligible.

On public lands, the past history of timber harvesting, openland management, prescribed burning, road reconstruction, and other management activities in the Middle River Project Area has had no detrimental long-term effect on water yield and or quality. No water resources on Forest Service ownership in the Middle River Project Area have been adversely affected by any past land use activities, when considered on a cumulative basis. Visual observation show the current condition of the old skid trails and log landings to be revegetated and stable. Proposed projects such as closing non-system roads, closing wells, fencing to limit access by livestock to wooded areas, constructing erosion control structures, and planting hardwood trees would all have a positive long-term effect on the water quality in Middle River. Spot application of herbicides on noxious weeds and fescue sod would not adversely affect the water quality when applied on this limited basis.

The activities on private land within the project area are not expected to change over the long term, and would therefore not have adverse cumulative effects on the Middle River Project Area. From review of aerial photographs and discussion with the Callaway County Farm Services Agency, private land south of Forest Service ownership, is primarily cropland in the bottomlands, and fescue fields with timber on the steeper uplands (Campbell, 2003, personal communication). Impacts of past coal and fire brick clay mining on private land in the area have been corrected through re-vegetation and stabilization. Many of these mining pits have been utilized as sediment traps and/or ponds. Most of the private lands north of Forest Service ownership is occupied by private homes and small livestock grazing and other farming operations. The activities of private landowners have not resulted in any documented water quality problems in the area.

Irreversible or Irretrievable Commitment on Resources:

None of the alternatives would have an irreversible or irretrievable effect on the water quality in the Middle River Project Area.

AIR QUALITY

Existing Conditions

The major physiographic features influencing the climate, movement and dispersion of smoke in this area is the Middle River Watershed and associated drainages such as Prime Creek. This river valley can act as a cold sink and trap smoke. This may cause it to settle near homes in the valley or disseminate down stream into nearby farms or towns.

In general, the air quality in the proposed project area is good. The entire proposed project lies within lands designated as Class II with respect to the air resource. The Clean Air Act defines a Class II area as, “A geographic area designated for a moderate degree of protection from future degradation of the air quality” (Clean Air Act, 1990). The closest Class I areas are the US Forest Service managed Hercules Glade Wilderness and the US Fish and Wildlife Service managed Mingo Swamp National Wildlife Refuge, both located approximately 250 miles south of the proposed project area.

All proposed activities are within Callaway County. The City of St. Louis and five counties in and around the city are the closest non-attainment areas. This determination is based on the Environmental Protection Agency’s (EPA) Aerometric Information Retrieval System (AIRS) and data maps. EPA defines non-attainment areas as “A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards.” St. Louis and the surrounding counties are approximately 90 miles east of the proposed Middle River Project Area. All these areas are non-attainment for ozone. The project area is designated as attainment for all six National Ambient Air Quality Standards (NAAQS). These six criteria pollutants are: Carbon Monoxide (CO), Particulate Matter (PM-2.5 and 10), Ozone (O₃), Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂) and Lead (Pb).

Of the six criteria air quality pollutants identified by the EPA, the main pollutants of concern for the proposed project area: 1) CO; 2) PM; and 3)Ozone. Although the other 3 pollutants are important, the levels associated with this type of project are typically well below NAAQS.

The main sources of carbon monoxide are from combustion engines associated with vehicles and to some extent from outdoor burning. The main sources of PM-10 and PM-2.5 are from local wood burning home units, prescribed burning on private lands, and dust from unsurfaced roads.

Direct and Indirect Effects on Air Quality by Alternative

All three alternatives contain prescribed burning projects: Alternative 1 has 400 acres that could be burned; Alternative 2 has 650 acres that could be prescribed burned; and Alternative 3 has 680 acres that could be prescribed burned. Environmental effects would be similar to all three alternatives regarding air quality, but Alternative 1 would just have a smaller effect. Alternatives 2 and 3 contain more wooded acres to burn, nearer to Middle River, and would have greater potential for the short-term effect of smoke accumulating in the valley of the river corridor.

All analysis for the proposed projects are based on potential impacts to the identified smoke sensitive receptors with respect to the NAAQS levels for Carbon Monoxide, PM-10, PM-2.5, Ozone and Visibility. The State of Missouri uses the same standards for the criteria pollutants as EPA. Based on modeled analysis, literature review and implementation of the identified mitigation measures, all NAAQS will be met for the project. Under state rule 10 CSR 10-3.030,4 (c.7), which deals with open burning in Missouri, the USDA Forest Service is exempt. Nevertheless, because the proposed activities are in an attainment area, the

conformity requirement would be met. The project would be in compliance with all federal, state and local regulations relating to air quality as well as with the Forest Plan.

The three basic objectives of smoke management are:

1. Identify and avoid smoke-sensitive areas.
2. Reduce emissions.
3. Disperse and dilute smoke before it reaches smoke-sensitive areas.

Table 9: Smoke Sensitive Receptors

Smoke Sensitive Receptor	Distance from Receptor to Fire (Miles)	Direction from Receptor to Fire
Highway 54	2.0	Northwest
Fulton	6.0	Northeast
New Bloomfield	3.0	Southwest
Holts Summit	7.0	Southwest
Highway BB	1.0	West

The above smoke sensitive receptors were used in the SASEM model to analyze the impact of the various alternatives at these locations. They were chosen based in part on proximity to the proposed project, known smoke concerns, safety concerns, and the ability to represent similar locations in the area. Identified smoke-sensitive areas were based on a South, Southwest wind pattern.

Strategies employed to reduce smoke emissions and promote smoke dilution and dispersion in all alternatives:

- The burn would occur during favorable moisture and weather conditions
- The burn would occur when the weather system is moderately unstable.
- Mixing heights would be $\geq 1500'$ and transport winds at 5 mph or more.
- Ignition would be started early in the day to take advantage of atmospheric heating.

Carbon monoxide as a product of combustion is rapidly diluted at short distances from a fire and therefore would pose little or no health risk to the general public. Fire fighters are at the greatest health risk because they have longer exposures at higher concentrations. It is recommended that fireline crew bosses rotate personnel away from the fireline to decrease their exposure. By doing this, they would be able to mitigate the health impacts to firefighters. This would be implemented under all alternatives, thus allowing the proposed activity to comply with NAAQS for carbon monoxide.

All alternatives have some potential to impact visibility. The smoke sensitive receptor with the greatest potential for impact would be Highway 54.

A number of factors were taken into account to minimize the smoke impact for the proposed burns in all alternatives. The burns are specifically designed to occur within an acceptable “window” of weather and fuel conditions. The time of year (spring) represents atmospheric conditions that afford good mixing heights. Air temperatures would be moderate to high with humidity and fuel moistures moderate to low. These factors would help to minimize the smoldering combustion phase in 60 to 70 percent of the fuels.

Light general winds from the southwest would prevail, influenced by local geographic convective winds; upslope and up canyon. During ignition, smoke would lift to the 1,500 level and disperse.

The burn would approximate natural low to moderate fire intensity, since it would occur under conditions approximating those of a mild wildfire; however, given the controlled conditions, visibility impairment and other smoke impacts would be less than those that occur with natural ignitions. The elevation and general wind direction would assist the lift and diffusion of smoke. Smoke would be carried aloft during the initial convective stages; once temperatures lower and humidity's rise in the evening and nighttime, any non-convective smoke would flow down the drainage and down slope. The residual smoke from the nighttime pooling should be minimal and readily lift the following morning with daytime heating.

Smoke from management-ignited fire is of great concern to the public. The amount of smoke emitted and its dispersal are affected by how and when the burn would be conducted. When fire is prescribed (managed), the atmospheric stability and wind direction are the keys for avoiding excessive problems in smoke sensitive areas. Due to the location of the burn, burning patterns to be used, size of project, fuel conditions and time of year, smoke from the project should have little impact on identified sensitive areas.

The public would be informed of the planned burning days and Forest Service employees would control traffic, if needed, along County Roads. Signs would be placed along travelways notifying the public there may be smoke along the road. Local, County and State law enforcement would be notified that the burning would be taking place. Notices informing the public of the potential burn days, times, contacts for information, and suggested alternatives for those concerned with smoke would be placed in newspapers and neighbors would be contacted. Smoke plume and visibility would be monitored.

In general, the air quality in the proposed project area is good. All six criteria pollutants are within National Ambient Air Quality Standards (NAAQS). Based on model runs using SASSEM, the emissions pose little or no health risk to the general public.

Direct effects may also include:

- Increases in particulate matter and carbon monoxide concentrations;
- Eye, nose, and throat irritations;
- Decreased visibility along travelways;
- Odor/nuisance of smoke.

In general the public, with exception of the very ill, very young, and the elderly, have a low risk of long-term chronic health impacts, such as asthma, pulmonary disease, or other respiratory disease from prescribed burns. This is due in part to the short exposure times, typically 15 hours or less, at concentrations that are below the NAAQS. Based on the proposed burning times, the nuisance of smoke should be short-term, less than 10 hours, for all alternatives. If climatic conditions change quickly, some travelways, such as Highway BB or Highway 54, may experience decreases in visibility of three miles or less. These impacts can be mitigated as mentioned above.

Indirect effects may include development of ozone precursors from the combustion process and the decrease in potential of exceeding NAAQS due to a decrease in fuels for wildfires. The amount of ozone precursors produces is small enough that they would not produce ozone levels that would exceed NAAQS. Decreasing

the amount of fuel loading would be a mitigation to decrease the potential for NAAQS being exceeded by a wildfire.

Cumulative Effects on Air Quality

A cumulative effects spatial boundary of Callaway County and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful regarding the air quality.

For air quality, cumulative effects include reasonable and foreseeable activities that produce pollutants. This includes, but is not limited to activities such as operation of combustion engines, use of fireplaces, dust from gravel roads, wildfires, industrial emissions, etc. These emissions coupled with the emissions from prescribed burning, may have the potential to exceed the NAAQS for ozone and PM-2.5. Based on the growth of these other activities that produce pollutants, the proposed project would be implemented before they reach a level that would cause NAAQS to be exceeded.

Much of the land base in Callaway County is in private ownership. Adjacent private lands to the Middle River Project Area are mostly homesites with woodlots and grazed pastures or hayfields. Most of these lands do not utilize prescribed burning as a management tool. Within five miles of the Project Area, there are approximately four private landowners who have utilized prescribed burning in management of native grasses (personal communication with Callaway County NRCS). These lands would contribute to air quality of the local area, but its' effects would be similar as discussed above. However, it is unlikely that each landowner would be burning on the same day or in the same year as proposed projects in the Middle River Project Area.

The Reform Conservation Area, the Whetstone Creek Conservation Area, and the Little Dixie Conservation Area, managed by the Missouri Department of Conservation, are other government-managed land in Callaway County where prescribed fire may be utilized. These areas, located approximately 10 miles, 25 miles, and 20 miles, respectively, from the Project Area, would not contribute to effects from proposed management on the Middle River Project Area. Tucker Prairie, managed by the University of Missouri – Columbia, is also managed with prescribed fire, but is located approximately 25 miles to the northeast of the Middle River Project Area. As mentioned on private land, it is unlikely that each of these areas would be burned on the same day or in the same year as proposed projects in the project area.

If exceeding NAAQS moves Callaway County into a non-attainment status, it may limit the use of fire as a tool or limit the number of industrial modifications or new facilities that produce any of the six criteria pollutants. At that time, the Forest Service would work with the Missouri Department of Natural Resources to develop state implementation plans that allow the state to make reasonable progress towards meeting NAAQS and allowing the Forest Service to continue using prescribed fire as a tool.

Irreversible or Irretrievable Commitment on Resources:

None of the alternatives would have an irreversible or irretrievable effect on the air quality in the Middle River Project Area.

TRANSPORTATION

Existing Conditions

The Middle River project area is within the 3.4-9 Management Area (MA). There is one National Forest System road within the project area boundary (FR 1686). The road is 0.9 miles in length. The 3.4-9 MA contains 1,300 acres or 2.0 square miles of National Forest System land. This equates to 0.4 mile of system road per square mile of Forest Service land. The Forest Plan, page IV-123, provides direction on the maximum density of system roads allowed within a 3.4 MA, which is 2-mile/square mile of Forest Service land. The road density for the 3.4-9 MA is below the Forest Plan's maximum density limit.

US Highway 54, secondary State Highways BB, NN and PP, and several Callaway County roads access the Middle River Project Area. Federal and State Highways have asphalt or concrete surfaces. County roads within the MA have an aggregate surface, whereas the National Forest System road has a native surface.

In addition to the system road, there are non-system roads on National Forest System land in the Middle River project area. Some have been in place since the early 1900's, when the entire area was first settled. Many of these roads have been used repeatedly for cattle grazing, timber harvesting and recreational pursuits. These early roads were inherited through land acquisition. The condition of these roads is usually fair to poor because no road improvement or maintenance work has ever been done. Those located on ridge tops are relatively stable, except for areas that become soft when wet. Those located on side slopes or in riparian areas are less stable and may become entrenched, rutted, or washed out. Regardless of their origin, the Forest Plan on page IV-85 gives direction that all roads under Forest Service jurisdiction "not shown on the Transportation Plan, or its subsequent revisions, shall be closed unless under special use permit". Some of the non-system roads have been closed by the District or have become inaccessible due to natural vegetation growing up, but many have remained open because of continued administrative and recreational vehicle use. Other non-system roads are under special use permit to allow access to private property. Any non-system road under special use permit for access to private property would not be closed. All roads that are open, including both system and non-system, receive some degree of vehicular traffic. Use occurs primarily on weekends for recreational driving, hunting, firewood gathering and other recreational pursuits.

Direct and Indirect Effects on Transportation by Alternative

Annual maintenance is a preventative measure and is used to stabilize an existing road, protect road investments, and minimize disturbance to surrounding resources.

Alternative 1 (No Action): No changes would be made to the existing 0.9 miles of system road within the Middle River project area. Current road conditions would be maintained. No roads would be reconstructed. Open non-system roads within the Middle River project area would remain open and continued sedimentation would occur. No temporary roads would be created. The management area's road density would remain at 0.4-mile/square mile. Public access to the area would remain unchanged. There would be no evident change in environmental effects, except that system roads, which need to be reconstructed, would continue to deteriorate if not eventually reconstructed.

Items common to all action alternatives (Alternatives 2 and 3): The Forest Plan, pages IV 81-85, identifies the general forest-wide management direction for roads; including construction, reconstruction, maintenance, closure and obliteration. The need for road construction, reconstruction, improvement or maintenance is based on proposed management activities, management area objectives, and the need for

resource protection. The intent of road construction or reconstruction is to provide long-term access into an area with the least amount of disturbance possible. Part of the “least disturbance” objective is to ensure resource damage does not occur in the future after a road has been constructed or reconstructed. Seasonal restrictions, access closures and proper construction would minimize disturbance to the area. Road construction or reconstruction increases the degree of soil and vegetative disturbance in the short-term while providing long-term load bearing strength and stabilization of the surrounding soil and vegetation. Roads are constructed or reconstructed to provide the minimum standard of road necessary for management area objectives. Road reconstruction would reduce seasonal access restrictions due to wet weather.

Alternative 2: Reconstruction of FR 1686 (0.9 miles of system road) would be required to access project activities. Reconstruction activities include removing infringing brush, correcting drainage problems, and providing a stable road surface by applying crushed aggregate base. Commercial sources of aggregate would be used. The system road density of the management area would remain unchanged since no new roads are planned. Approximately 0.4 miles of non-system roads would be closed, decreasing sedimentation and improving the water quality of the project area. Types of road closure devices used may include one or more of the following: berms, boulders, gates, and obliteration. Other non-system roads within the project area are already closed with gates. Any non-system road under special use permit for access to private property would not be closed.

Alternative 3: The direct and indirect effects of the actions in Alternative 3 would be the same as in Alternative 2.

Table 10: Comparison of Transportation System by Alternative

	Alternative 1	Alternative 2	Alternative 3
Total miles of system roads	0.9	0.9	0.9
Road density (Miles/Square Mile)	0.4	0.4	0.4
Miles of system road to be reconstructed	0.0	0.9	0.9
Miles of non-system road for closure	0.0	0.4	0.4

Cumulative Effects on Transportation

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful regarding the road system.

The road density for each of the alternatives would be 0.4-mile/square mile, which is less than the 2-mile/square mile allowed in the Forest Plan for MA 3.4. On surrounding private lands, no new County

Roads are planned. Access roads to private property may increase in the future, but would have little effect on the Project Area. Decrease in sedimentation and erosion would occur from the proposed closing of non-system roads in both Alternatives 2 and 3; overall watershed quality of the project area would improve. Past, present, and proposed future transportation system activities do not pose any appreciable cumulative effects on access to or use of the Middle River Project Area or its vicinity for each of the alternatives.

Irreversible or Irretrievable Commitment on Resources:

None of the alternatives would have an irreversible or irretrievable effect on the transportation system in the Middle River Project Area.

BIOLOGICAL ENVIRONMENT

VEGETATION

Existing Conditions

The project area contains about 1300 acres of National Forest System Land (NFSL) and is within the oak-hickory forest type. The oak-hickory forest is interlaced with cedar stands and open land in both cool and warm season grasses. As mentioned previously, most of the present public lands in the Cedar Creek Unit were acquired during the 1940's under Title II of the Bankhead Jones Farm Tenant Act of 1937. Under the Act, the Soil Conservation Service, now known as the Natural Resources Conservation Service (NRCS), undertook a restoration program to correct years of land abuse due to overgrazing, cropping on unsuitable soils, and clearing of timber. Within the Middle River Project Area, some trees, including pine and locust, were planted to control erosion, ponds were constructed, and grasses planted.

Grazing was permitted on the land suitable for such use, and in 1951, the NRCS entered into a cooperative agreement with a group of farmers who organized as the Cedar Creek Grazing Association. The purpose of the agreement was to secure the cooperation of the farmers in maintaining the improvements, fertility of the land, and the productivity of the pastures. After the lands were transferred to the Forest Service in 1953, the grazing association continued to function and assist in management of the openlands on the district. The Middle River Project Area contains lands acquired during this time, and includes openlands maintained with the assistance of the Grazing Association since that time.

The following table shows the existing vegetative condition of the project area.

TABLE 11 -- Existing Vegetation in Project Area		
Vegetation Type	NFSL Existing Acres	% of Project Area
White/Red Oak/Hickories	586	45%
Cedar/Hardwoods	157	12%
Bottomland Hardwoods	55	4%
Locust	5	1%
Total Forested	803	62%
Non-Forested (Open/Brushy)	493	38%
Total	1,296	100%

The majority of the open lands originated from forested acres cleared for agricultural purposes when settlers arrived. The areas which remain currently open are either currently being grazed or had been grazed in the past. See Chapter 4 for more discussion on openland habitat management. The Forest Plan's wildlife habitat guidelines for permanent openings in this management unit are 10-20% (LRMP IV-120).

The Cedar/Hardwood cover type is invading on lands abandoned after clearing for crops or pasture and that have not been maintained due to poor access or slope. The acres containing locust species are also abandoned agricultural area that was planted by the NRCS.

The Oak/Hickory forest occupies 45 percent of the government ownership. These stands occur on lands that have retained their forest cover through the past century due to inappropriateness for crop or pasture clearing, mostly due to slope restrictions. Approximately half of the oak forest type is dominated by the longer-lived white oak trees in the overstory with associated other hardwoods and cedar. Another 12 percent consists primarily of the shorter-lived red oak group, which includes pin oak, northern red oak, and black oak. The remaining 38 percent is a mixture of oaks with no one type predominating. Of the red oak group, 2 percent is immature with the rest considered mature or over mature. Forty percent of the white oak group is immature with the rest considered mature or over mature.

A commercial timber sale was conducted on the area in 1995-1996 in Compartment 10. This uneven-age management hardwood sale thinned or made small regeneration openings on 150 acres. This area of the forest now has the highest number of young oak trees, which are needed if a healthy oak forest is to be perpetuated. In 1986, 6 acres of oak were thinned in the project area. Various areas within Compartment 9 have received some wildlife edge thinning in the 1980's through firewood removal.

According to data from the 1989 Forest Inventory (Kingsley and Law, 1991), about 34% of Callaway County is timberland (defined as capable of producing 20 cu.ft/ acre and therefore larger trees). About 80% of the timberland is forest type oak-hickory, and about 51% of the timber is 9" diameter breast height (dbh) or greater. The National Forest Service owned timberland makes up 4% of the timberlands in Callaway County. There are about 3,400 acres of private land within the boundaries of the 3.49 management area.

Direct and Indirect Effects on Vegetation by Alternative

Alternative 1: No Action.

In this alternative, 475 acres of openland would continue to exist and be maintained in this alternative. This would include prescribed burning, grazing and mechanical means of openland maintenance (such as mowing). The existing 83 acres designated as old growth in Compartment 10 would continue to be managed as old growth. No other management actions are proposed. Changes to woodland vegetation would be a result of natural disturbances or human-caused wildfires. Wooded acres would grow older with closed canopies. As the red oak group continues to die out, white oak would become the dominant species with more dense understories of sugar maple occurring.

Natural events such as wind storm, hail, drought, and insect and disease attacks would cause changes in vegetative structure and composition. In some stands, eastern red cedar would become more dominant. Generally these factors cause small isolated areas of over-story trees to die out. Where these openings may be large enough, seedlings of more light-dependent species (such as oaks and hickories) would have a better

chance of sprouting and competing. However, more shade tolerant species such as maple are often already established and can dominate the understory.

This alternative does **not** meet the forest plan by diminishing the following conditions (LRMP, IV-120):

- woodland forb understory component
- oak regeneration potential
- smaller oak size classes
- diverse mosaic of stands
- production of resources

Alternative 2: Proposed Action. This proposal is being made to enhance wildlife habitats (as guidelines in the LRMP on page IV-120), improve watershed health, and improve recreation. Some wildlife habitats are overabundant while others are deficient. Existing stand conditions, site quality and spatial distribution were factors used to select where changes in the vegetation could be made to create the desired balance of habitats.

In this alternative, 400 acres of openland pasture would be maintained and grazed, 45 acres of openlands would be planted to hardwoods, and 30 acres of open/semi-open habitat would have no prescribed burning, to allow these acres to grow into woody habitat. This would reduce the amount of open/semi-open habitat working towards the LRMP desired future condition.

Use of herbicides, such as glyphosate, to treat fescue grass where hardwoods are proposed for planting would improve survival of seedlings by eliminating fescue sod. Soil effects of chemical use are discussed in the Soils section of this document. These herbicides would only be utilized in spot treatments for planting, utilizing recommended doses per the manufacturer. Desirable vegetation would not be treated. Therefore, the overall effects of this treatment would be minimal to desirable vegetation and improve the potential for desirable hardwood survival. Chapter 4 contains further discussion on plant composition and noxious weed control.

Also in this alternative, an additional 107 acres are proposed for old growth designation (83 acres are already designated old growth in the project area; therefore a total of 190 acres old growth in Alternative 2). Some of the stands designated are not old growth at this point. This designation would concentrate old growth in blocks and near drainages to provide habitat for species of animals and plants that require little or no disturbance. In addition, they would serve as travel corridors for animals and provide visual retention areas for scenery. Natural disturbances would determine the forest's structure. Individual trees would die from natural causes and eventually fall to the ground, providing a source of dead woody ground cover. The fallen trees would slowly decompose and provide organic matter to the soil. Larger areas of trees may be killed by windstorms, insect or disease problems, early or late frost and fires. This designation would allow for development of old growth characteristics such as down woody material, cavities, broken tops, and a multi-layered canopy.

Creation of woodland habitat with 20-30% forbs, grass and shrub components would occur on 460 acres through uneven-aged management. This would include single and group tree selection. Included in this prescription would be follow-up regeneration work to improve oak regeneration. This regeneration work

would not be ground disturbing, but would include control work by hinging maples to reduce growth and sprouting. As elsewhere on the district, many stands have been accumulating tolerant understories of sugar maple (*Acer saccharum*). This has resulted in a closed canopy mid-story in many stands. The lack of light to the understory from the lack of disturbance of the main stand and the development of tight midstory canopies has resulted in a lack of oak reproduction. Without disturbance through management, a larger component of mature maple may occur. Maple does not provide the food source (mast) for wildlife that oak/hickory overstories can. Other stands have a component of cedar in the hardwood stands. Removal of some of these cedar trees would improve hardwood survival and produce a more diverse woodland habitat. There would be approximately 350 acres of oak/hickory management and 110 of cedar-hardwoods in this alternative. Additionally, 250 acres of woodland understory burns would add to forb diversity and numbers.

Through the variety of openings created within these woodlands, a variety of intolerant tree species, forbs, grasses, species would respond to the increase in sunlight. This would be more pronounced in the larger openings and less vigorous in the smallest openings. Native grasses, forbs, and wildflowers would develop in the openings, providing a diversity of plant species and habitat for wildlife.

Where cattle are grazing the woodlands (usually in field edges or “fingers”), the woody vegetation within reach is noticeably lacking. In some cases this has prevented the maple or other shade tolerant species from establishing. However, there is little accumulation of advanced tree reproduction necessary for long-term oak management. Proposed fencing in several woodland acres would limit cattle access into woodlands and drainages.

Firewood follow-up in the Middle River Project Area would be utilized to clean up tops and logs left after logging operations. This would provide firewood opportunities for local homeowners.

This alternative contributes to the following forest plan objectives:

- Reforests 45 acres of present openland by planting desirable native hardwood species; 30 acres of open/semi-openland would be allowed to naturally regenerate to woody species (these 30 acres would not be burned).
- Provides for control of state listed noxious weeds on 59 acres, which would also contribute to better distribution of desirable vegetation.
- Designates old growth percentage to 15% of total project acres, which is 24% of the woodlands in the Project Area.
- The timber sales proposed would help maintain and develop various age and size classes of desirable oak vegetation in the following ways:
 1. Creates growing space necessary for current younger trees to develop
 2. Creates sunlight on the forest floor for oak regeneration establish, providing the 0-9 age component.
 3. Creates growing space for best trees in the main canopy, increasing tree vigor, growth, size, and mast production.
- The timber sales would contribute to forest plan objective of moderate to high production on other resources by providing sawtimber, posts, and firewood.
- The increase in canopy openings from timber sales would directly increase the forb diversity and numbers.

Alternative 3: In this alternative, openlands and old growth habitat issues were addressed, particularly through Interdisciplinary Team input and analysis as well as public comments generated during scoping and the 30 day comment period. The changes from Alternative 2 include:

- 430 acres of open/semi-open wildlife habitat would be maintained. In this alternative, the grazed, openland stand would not be planted to trees, but would remain open. It would be maintained in its present state through a combination of prescribed burning, mowing and/or grazing.
- 8 acres of present openland would be planted to desirable native hardwood species; 30 acres of open/semi-openland would naturally regenerate to woody species (these 30 acres would not be burned).
- Proposed old growth stands would be modified, changing the locations and some stand boundaries, but the overall percentage of old growth in the project area would remain similar. In this alternative, in Compartment 9, stands 57 and 58 would be created and be designated as old growth, reducing the number of acres in stands 33, 27 and 53; Stand 25 in Compartment 9 would also be designated as old growth. In Compartment 10, stand 13 would not be included in the old growth designation.

Environmental effects would be similar to Alternative 2, however more acreage would remain in open/semi-open habitat. However, the project would be working towards the DFC by still reducing this habitat type, but to a somewhat lesser degree than Alternative 2. Old growth habitat acres would remain similar to Alternative 2, but be arranged differently. By adding a stand to old growth near the block at Middle River and adjusting stand boundaries to conserve the unique qualities along several drainages, this old growth component would provide a diverse habitat and an improved viewshed. Removing stand 13 in the Compartment 10 from old growth component that had some previous harvesting would provide for additional timber follow-up work in this area. Although not all these stands are old at this point, placing them in old growth would allow them to grow into this category. Effects of herbicide use in planting would be less, since fewer acres are proposed for hardwood planting.

This alternative contributes to the following forest plan objectives:

- Reforests 8 acres of present openland by planting native hardwood species to reduce the openland percentage.
- Provides for control of state declared noxious weeds on 59 acres, which also contributes to better distribution of desirable vegetation.
- Designates old growth percentage to 15% total acres, which is 24% of the woodlands in the Project Area.

Indirect Effects:

In both Alternatives 2 and 3, approximately 35% of the total project area would have uneven-aged harvest conducted upon them. The overall effects to the woodland character of the area would be minimal. Viewsheds along the Middle River are either in old growth or being planted to trees.

The open/semi-open habitat being provided has diverse structure and plant species including native grasses and wildflowers. Within the private land in the surrounding area, much of the openland is in grazed or hayed pastures, with timber concentrated along the drainages and stream corridors. Wildland urban interface is increasing, as more private tracts are being divided into smaller acreages for home development.

Cumulative Effects on Vegetation

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effect temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Past actions that have affected the Forest Service lands in this area have been: logging prior to Forest Service ownership to clear land for openlands, farming, haying and grazing. Because of erosion concerns when the NRCS managed the land, some of it was planted to non-native and native trees to help hold the soil, ponds built, and areas planted to native grasses and non-native cool season grasses such as fescue. Some recent timber harvesting has occurred in Compartment 10.

Private lands would provide lower quality openland habitat in the form of grazed and/or hayed fescue pastures. Within several miles of the Project Area, there are several landowners who have established native warm season grass and have utilized some timber management activities. Some bottomlands in the area are in cropland production, particularly outside and south of the project area. Woodlands on private lands would provide less diverse woodland understories, except in the neighbors who have conducted some wildlife and timber management activities. A number of years ago, coal and firebrick clay mining had occurred on private lands to the northeast of the project area with resulting land disturbance. However, these areas have mostly stabilized with herbaceous and woody species, with resulting ponds utilized for recreational fishing. No lands managed by other agencies such as the Missouri Department of Conservation (MDC) or Missouri Department of Natural Resources (DNR) lie in the Middle River Breaks.

Alternative 1: In the timbered stands, trees would grow older, with the under-story trees and vegetation dying out. There would be some variety of vegetation within small openings created by natural tree mortality. Maple would occupy gaps in the canopy. Openlands that are not being maintained would slowly convert through natural succession to a more woody component.

Alternative 2 and 3: In these two alternatives, the cumulative effects to the woodland habitat would be similar. The woodlands would be maintained through the use of uneven-age management. This along with the proposed prescribed burning would increase the amount of grass, forbs and shrubs in the understory. Oak/hickory regeneration would be encouraged, providing a food source for wildlife and a new age class. Old growth habitat characteristics would continue to develop in the areas designated. Less openland habitat would be maintained in Alternative 2 than Alternative 3, but the overall openland habitat and the associated species utilizing these areas would not be greatly affected. The diversity of openland species would be continued through the variety of maintenance activities proposed. The general appearance of the National Forest System land would be a managed forest with more successional stages represented.

The cumulative effects of spot treatments of herbicide to treat noxious weeds and tree planting survival would be minimal, but would improve the native plant diversity.

Irreversible or Irretrievable Commitment on Resources:

None of the alternatives would have an irreversible effect on the vegetation resources. In the harvesting alternatives, trees harvested would be lost, but new trees would sprout to form new growth within the area.

PLANTS

The diversity of plant species has varied throughout Missouri for centuries. Prior to the European settlement of the area, fire played a major role in the area. Climatic changes, geographic location and the diversity of its landscape have all influenced the ecological communities that exist today. The species existing at one point in time may be completely replaced by other species over time because of the constantly evolving and changing habitat (includes plant succession). Some of the factors which influence the type of plants in an area include (but are not limited to): climate, slope, aspect, type of soil, amount of sunlight, amount of nutrients, the amount and duration of available water, stage of succession (ex. early forest successional stage) and parent material.

• THREATENED, ENDANGERED AND PROPOSED PLANT SPECIES

Existing Conditions

The U.S. Fish and Wildlife Service species list dated 07/31/02 was utilized (the 12/29/03 USFWS species list had no changes from the 7/31/02 species list). The U.S. Forest Service is legally required to provide protection to ensure survival of federally listed species. Information from the Missouri Department of Conservation's Heritage Survey Database was utilized in the completion of this section.

There are no Threatened, Endangered and Proposed Plant Species that are documented to occur in or that have suitable habitat in the Middle River Breaks portion of the Oak Hickory Hills LTA.

Threatened, Endangered and proposed plant species that are documented to occur in Callaway County, but not in the Middle River Breaks portion of the Oak-Hickory Hills LTA.

Running buffalo clover (*Trifolium stoloniferum*) is associated with semi-shaded woods and needs slight levels of disturbance. This disturbance was often caused by large ungulates such as bison. There are no documented Running buffalo clover in the Middle River Project Area. Succession, the lack of disturbance and the lack of fire has resulted in a loss of this habitat. *Note: there were several introductions in Callaway County in the early 1990's of the Running buffalo clover approximately 5 air miles to the North. Many of these died from a virus infection (Hickey 1994). None of the surviving plants had any flowers in 1997. (Hickey 1997)*

Direct, Indirect and Cumulative Effects (Threatened, Endangered and Proposed Plant Species):

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Because of the location of the Running Buffalo Clover introductions, there would be no direct, indirect or cumulative effects on this species as a result of any activities in the Middle River Project Area.

Note: Because this T&E plant species and its habitat does not occur in the Middle River Project Area, the Middle River Hills portion of the Oak-Hickory Hills LTA it will not be discussed any further in this document.

• REGIONAL FORESTER SENSITIVE PLANT SPECIES

The National Forest Management Act (NFMA) regulations of 36CFR 219.19 specify that fish and wildlife habitat will be managed to maintain viable populations of existing native and desired non-native species. This requirement is further developed in Chapter 2670 of the Forest Service Manual, which establishes a “Sensitive” category to include animal, plant, and fish species in addition to indicator species whose viability is a concern to the Forest Service. The objective is to ensure that these species do not become threatened and endangered because of Forest Service actions. The February 29, 2000 (including October 23, 2003 list update), Forest Service R-9 Regional Forester Sensitive Species (RFSS) list was utilized. *Additional information is contained in the Biological Evaluation for Sensitive species located in Appendix G.*

Existing Condition

There are no documented Sensitive plant species sightings in the Middle River Project area or the Middle River Breaks portion of the Oak Hickory Hills LTA.

While they are not known to occur in the Middle River Project area or the Middle River Breaks portion of the Oak Hickory Hills LTA, these sensitive species are found in the Oak Hickory Hills LTA and in prairies and are fire dependant species:

Yellow coneflower (*Echinacea paradoxa* var *paradxa*): This occurs in open areas such as glades, bald knobs or in prairies. It prefers openings larger than 1 acre in size. It also likes areas with a 0-50% crown closure. This coneflower has been found near roadsides. This species is often found in areas that are maintained by fire.

Wavy Leaf purple coneflower (*Echinacea simulata*): This coneflower occurs in openings such as glades, savannas and on prairies. This species is often found in areas that are maintained by fire.

Royal Catchfly (*Silene Regina*): This species likes open areas such as glades, bald knobs, savannas and rocky prairies with a canopy closure between 0 and 55 percent. It has also been observed along old logging roads. This species is often found in areas that are maintained by fire.

Sensitive plant species which are not likely to occur in the Middle River Breaks portion of the Oak-Hickory Hills LTA, and Middle River area due to a lack of suitable habitat:

This includes the: Purple false foxglove, Wood Anemone, Tradescantia aster, Forked aster, Large-leaf aster, Offer hollow reedgrass, Bush’s poppy mallow, Marsh bellflower, Buxbaum’s sedge, Cherokee sedge, Fibrous-root sedge, Epiphytic sedge, Large sedge, Sharp-scale sedge, Dioecious sedge, Tussock sedge, Rigid sedge, Fox sedge, Ozark chinkapin, Southern cayaponia, Ivy treebine, Trelease’s larkspur, Yadkinense panicgrass, Open-ground whitlow-grass, Small flower throughwort, Pale avens (*Geum virginianum*), Featherfoil, Whorled pennywort, Large whorled pogonia, Weak rush, Small-fruit seedbox, Baldwin’s milkvine, Bog buckbean, Large-leaf grass-of-parnassus, Carolina phlox, Spotted phlox,

Knotweed leaf-flower, Yellow-fringed Orchid, Small green woodland orchid, Southern rein orchid (*Platanthera flava flava*), Pale green orchid, Halberd-leaf tearthumb, Spotted pondweed, Nuttall's oak, Harvey's beakrush, Orange (Sullivant) coneflower, Narrow-leaf pink, Gibbous panic-grass, Canby's bulrush, Weakstalk bulrush, Kidney-leaved sullivania, Ozark spiderwort, Ozark trillium, Yellowleaf tinker's weed, Ozark cornsalad, Northern arrow-wood, Barren strawberry, A liverwort (*Metzgeria furcata*), Yellow starry fen moss, A moss (*Dichelyma capillaceum*), A moss (*Seligeria donniana*), Narrowleaf peatmoss, Sphagnum moss, Log fern (*Dryopteris celsa*), Goldies woodfern, Netted chain fern, Butternut, Oval Ladies' Tresses, Fissa sedge, Straw sedge, Bush's skullcap, Gattinger goldenrod, and Pale Manna grass. *Note: Because these Sensitive plant species and their habitat does not occur in the Middle River Project Area including the Middle River Hills portion of the Oak-Hickory Hills LTA they will not be discussed any further in this document.*

Direct and Indirect Effects for Regional Forester Sensitive Plant Species by Alternative

Yellow coneflower:

Alternative 1: No Action

Because this is a fire dependant species, if no prescribed fires were to occur in the area, the amount of existing Yellow coneflower habitat would continue to be reduced and may be even be lost eventually due to plant succession. In open areas maintained by grazing, fire and mechanical means, this plant habitat would be maintained.

Items common to all action alternatives (Alternative 2 and 3):

These alternatives would burn the area where Yellow coneflower habitat may potentially be found. Prescribed burning would benefit potential habitat by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns' enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat. The use of herbicides would not have a direct effect on this species because it does not exist in the Middle River Project Area. However, it could have an indirect effect of helping to maintain the open conditions that this species requires by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres.

Alternative 3:

This alternative burns a total of 680 acres, of which 430 consist of openland acres.

Wavy leaf purple coneflower:

Alternative 1: No Action

There is no existing Wavy leaf purple coneflower habitat in the Middle River Project Area.

Items common to all action alternatives (Alternative 2 and 3):

These alternatives would burn the area where Wavy leaf purple coneflower habitat could potentially be found. Prescribed burning could benefit potential habitat by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat. The use of herbicides would not have a direct effect on this species because it does not exist in the Middle River Project Area. However, it could have an indirect effect of helping to maintain the open conditions that this species requires by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres. This burning would help the habitat for this fire dependant species.

Alternative 3:

This alternative burns a total of 680 acres, of which 430 consist of openland acres. This burning would help the habitat for this fire dependant species.

Royal Catchfly:**Alternative 1: No Action**

Because this is a fire dependant species, if no prescribed fires were to occur in the area, the amount of existing Royal catchfly habitat would continue to be reduced and may even eventually be lost due to plant succession. Fewer acres than in Alternative 2 or 3 would be burned, so less habitat opportunities would exist.

Items common to all action alternatives (Alternative 2 and 3):

Prescribed fire would help to enhance and/or maintain any potential Royal Catchfly habitat, by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat. The use of herbicides would not have a direct effect on this species because it does not exist in the Middle River Project Area. However, it could have an indirect effect of helping to maintain the open conditions that this species requires by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres.

Alternative 3:

This alternative burns a total of 680 acres, of which 430 consist of openland acres.

Cumulative Effects for Regional Forester Sensitive Plant Species

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of

the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Yellow coneflower and Wavy leaf purple coneflower:

Timber harvest has resulted in a short-term increase of their habitats. Conversely fire suppression has resulted in a decline of their habitats. Land clearing for agriculture and/or home sites on private lands has resulted in a change (positive and negative) to their habitat. Areas that are converted to row crops and/or lawns do not provide suitable habitat for these species. Over time, conversion of native prairie grasses to non-native fescue fields on private lands has resulted in a loss of potential habitat. However, some private landowners near the Project Area have converted a portion of their openlands to native, warm season grasses (NRCS, 2003). The use of herbicides would help to maintain the conditions that these species require by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Encroachment of cedars and hardwoods into field edges and old fields is resulting in a reduction of the open habitat required by these species. Maintenance of openlands on Forest Service lands through grazing would benefit both of these species. A wildfire could occur on either Forest Service or private lands, which could enhance or create some habitat for these fire-dependent species.

Royal Catchfly:

Timber harvest has resulted in an increase of their habitats. Conversely fire suppression has resulted in a decline of their habitats. Land clearing for agriculture and/or home sites on non Forest Service system lands has resulted in a change (positive and negative) to their habitat. Areas that are converted to row crops and/or lawns do not provide suitable habitat for this species. The conversion on private lands from native prairie grasses to non-native fescue fields has resulted in a loss of potential habitat. The use of herbicides would help to maintain the conditions that these species require by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Encroachment of cedars and hardwoods into field edges and old fields is resulting in a reduction of open habitat required by this species. Maintenance of openlands on Forest Service lands through grazing would benefit this species. A wildfire could occur on either Forest Service lands or private lands, which could open up more areas and thereby create more Royal catchfly habitat than a low-intensity prescribed fire(s) could.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable effect on the Forester Sensitive Plant Species in the Middle River Project Area.

• State of Missouri Endangered Plant Species

The March 1, 2003 State Endangered species list (section 3CSR10-4.111 of the Wildlife Code of Missouri) was utilized in the preparation of this section.

Existing Condition

There are no documented State of Missouri Endangered plant species in the Middle River Project Area.

State of Missouri Endangered Plant Species that have suitable habitat in Callaway County and are documented to occur in Callaway County:

Running Buffalo Clover (See the Plant Threatened, Endangered and Proposed species section).

State of Missouri Endangered Plant Species that are not documented to occur in Callaway County due to a lack of suitable habitat:

The other State of Missouri Endangered species not already covered are the Meads Mildweed (See the Plant Threatened, Endangered and Proposed species section), Decurrent false aster, Missouri bladderpod, Geocarpion, Pondberry, Small whorled pogonia, Eastern Prairie fringed orchid and the Western Prairie fringed orchid. *Note: Because these plant species and their habitat does not occur in the Callaway County, Middle River area including the Middle River Hills portion of the Oak-Hickory Hills LTA, they will not be discussed any further in this document.*

Direct, Indirect and Cumulative Effects for State of Missouri Endangered Plant Species

Because these State Endangered species and their habitat do not occur in the Middle River Project Area or Callaway County there would be no direct, indirect or cumulative effect on these species.

Irreversible or Irretrievable Commitment on Resources

Because these State Endangered species and their habitat does not occur in the Middle River Project Area or Callaway County there would no irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

Old Growth**Existing Condition**

The main factors required to meet old growth characteristics include (1) large diameter trees (the size needed may vary because a trees longevity varies by species), (2) evidence of large tree deterioration such as broken or dead tops and limbs, top and/or bottom rot, and cavities, (3) large standing snags and large logs on the ground. However, old growth stands may vary due to such factors such as the age, ecological land type, a site's capability, the species composition and the site's history.

The Middle River Project Area is located at the very northern edge of the Oak Hickory Hills LTA, and just below Bluestem prairie area (glaciated plains). The diverse natural communities in the area have changed significantly over the past 150 years. Logging, open range grazing by domestic livestock, changed frequency and intensity of fires, and extirpation of bison and elk altered this original natural landscape and vegetation. Fire suppression in the early 1900's resulted in a major increase in even-aged woody vegetation now enclosing former prairies, savannas, and open woodlands. Today the majority of the Cedar Creek Unit (including the Middle River Project area) consists of old fields with fingers of timber along drainages. Due

to the younger age of this area, the amount of large old trees is currently limited in the Cedar Creek Unit area.

According to the Mark Twain Forest Plan, the DFC for old growth in Oak-Hickory Hills LTA is 10-15 percent. The Middle River Project Area currently contains 83 acres (6 percent of the project area) in designated old growth.

Direct and Indirect Effects for Old Growth by Alternative

Alternative 1 (No Action):

In some areas continued fire suppression would allow some forested areas to continue to mature. While the amount of existing old growth would remain the same, there would be no additional Old growth designation.

Items common to Alternatives 2 and 3:

The intensity of the proposed prescribed burns is not enough to impact and modify old growth habitat. Therefore, these burns would maintain the amount of existing habitat.

Note: Longer-lived species, such as white oaks, were favored overall in the new old growth designation process. In addition contiguous blocks were also chosen. Designating stands of old growth in larger blocks would help assure these stands are managed for old growth in the future as long as old growth characteristics are still present. These actions would maintain viable populations of MIS and other species that utilize old growth habitats.

Alternative 2:

This alternative would designate a total of 107 additional acres of Old Growth. The total amount of designated Old Growth in the Middle River Project Area would be 190 acres or 15%. This alternative would designate a larger block of old growth in Compartment 10 as compared to Alternative 3. No timber would be harvested in any designated Old Growth stands.

Alternative 3:

This alternative would designate a total of 106 additional acres Old Growth. The total amount of designated Old Growth in the Middle River Project Area would be 189 acres or 15%. This alternative would designate a larger block of old growth adjacent to Middle River in Compartment 9. No timber would be harvested in any designated Old Growth stands.

Cumulative Effects for Old Growth

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

A wildfire could occur at any time on either Forest Service or private lands. An intense fire could destroy some old growth habitat. By fire potentially eliminating some trees in an area, the remaining trees would grow larger, thereby allowing them to develop old growth characteristics earlier.

Land clearing on private lands for agriculture and/or home sites and timber harvest has resulted in the loss of this habitat. Designation of old growth in the Middle River Project Area would provide a needed habitat by protecting these trees. Conversely fire suppression has resulted in an increase of this habitat on private lands.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

WILDLIFE

Note: This wildlife write-up includes information on mammals, birds, amphibians (includes salamanders), reptiles, mollusks, insects, fish species, and crustacean and their habitat.

Database, Reference Material and Survey Information

In partnership with the Mark Twain National Forest and others, the Missouri Department of Conservation (MDC) has been very aggressive in conducting species surveys and maintaining data on both listed and common species.

Databases:

The Missouri Heritage Database not only includes specific locations of plant and animal species, but also includes occurrences of unique and/or rare natural communities. Many of these communities are suitable habitat for Federal Threatened and Endangered Species (T&E), and/or Regional Forester's Sensitive Species (RFSS, of February 29, 2000, including October 23, 2003 list maintenance). MDC Heritage Survey database is where all occurrences of terrestrial and non-terrestrial species in Missouri are officially documented.

MDC maintains the Missouri Fish and Wildlife Information System (MOFWIS). MOFWIS contains information on over 700 species that are found in the State of Missouri. It includes information on numerous T&E, RFSS, State of Missouri Endangered species, State of Missouri species of concern and other species. The information includes, but is not limited to a species documented sighting records, counties of occurrence, their life history, habitat requirements, effects (beneficial/adverse) from various activities, and references.

The above two databases provide an excellent and up-to-date information source for numerous species. The MTNF contribute and utilizes information from these databases. *Note: The two above sites can be accessed at www.conservation.state.mo.us/nathis/.*

Reference Material:

Species' experts in Missouri have also been very aggressive in publishing excellent reference material that includes specific species information such as their locations in the state and their habitat needs. The publications include: *Missouri Wildflowers*, *Missouri Orchids*, *Field Guide to Missouri Ferns*, *Walk Softly Upon the Earth (Lichens and Mosses)*, *Steiermark's Flora of Missouri, Volume 1*, *Butterflies and Moths of Missouri*, *The Crayfish of Missouri*, *The Fishers of Missouri*, *Naiades of Missouri*, *Birds of Missouri*, and *the Amphibians and Reptiles of Missouri*. These publications were utilized during the preparation of the following sections, including the evaluation of potential effects to the numerous species and/or their habitats in the Middle River Project Area.

The MTNF prepares the Wildlife, Fish, and Rare Plants (WFRP) Monitoring Report that includes information on trends of habitats, Management Indicator Species, and T&E species.

The Nature Conservancy maintains Element Stewardship Abstracts and Element Global Rankings that give specific information on species' locations, habitats, threats, propagation, life history, etc. These data sources were also consulted when analyzing potential effects of project implementation.

Surveys:

Botanical surveys were conducted on the Houston/Rolla/Cedar Creek Districts during the 1990s. Spring-fall mist netting of bats was conducted on the MTNF in 1997, 1998, 1999, 2001, and 2002. Bat surveys were conducted in the summer of 2003 in the Middle River Project Area.

MDC had two fish sample sites within several air mile of the Middle River Project Area.

In addition to the extensive fieldwork done in preparation of the Missouri Heritage and MOFWIS databases and the publications, there are numerous field surveys conducted annually or as part of research projects in Missouri. The MTNF also has conducted surveys in partnership with others, or on its own. A sampling of these include, but are not limited to: annual mid-winter eagle surveys, Forest bat surveys (cave, fall, summer, winter, mist-net, harp-trap, Anabat), Missouri Breeding Bird Atlas, Missouri Breeding Bird Survey Routes, Furbearer surveys, Cave Research Foundation, Biological Inventories, Gardner and Gardner Cave Inventories, Botanical Surveys and Accipiter nest searches.

The information available on Threatened, Endangered, Proposed, and Sensitive (TES) Species locations and potential habitats in the Middle River Project Area is of sufficient quantity, quality, and relevance to make an accurate and complete analysis of potential effects on TES species in the project area. Enough information is available to make a reasoned management decision; therefore additional surveys are not needed for this project decision.

General Background

Wildlife within the Middle River Project Area is typical of the Middle River Breaks portion of the Oak Hickory Hills Land Type Association (LTA) that comprises the Middle River Project Area.

The diversity of wildlife species has varied throughout Missouri for centuries. Climatic changes, geographic location, and the diversity of its landscape have all influenced the ecological communities that exist today. Prior to the European settlement of the area, fire played a major role in the area. The type of wildlife species present is directly related to the amount and type of vegetation that is present.

The type of wildlife species present is constantly changing as succession continues. No one successional stage is best for all wildlife species, including TES and MIS. The species existing in an area may be completely replaced by other species over time because of the constantly evolving and changing habitat.

Occurrence and distribution of a species depends on if there is suitable habitat in the area for that species. Some of the suitable factors include, but are not limited to: the type of existing vegetative cover, structure, an existing prey base, and their spatial distribution in the area.

Information on the occurrence and distribution of invertebrate species is lacking for Missouri. To our knowledge, there is no research currently being done on invertebrate species occurrence and/or distribution in Missouri. Because of the vast number of species, their small physical size, and the lack of on-going research it is unlikely that information would be available for the foreseeable future.

- **Threatened, Endangered and Proposed Wildlife Species**

Existing Conditions

The U.S. Fish and Wildlife Service species list dated 7/31/02 was utilized (the 12/29/03 USFWS species list had no changes from the 7/31/02 species list). The U.S. Forest Service is legally required to provide protection to ensure survival of federally listed species. Information from the Missouri Department of Conservation's Heritage Survey Database was utilized in the completion of this section. *Note: Additional information is contained in the Biological Assessment for Threatened, Endangered and Proposed species in Appendix G.*

There are no Threatened, Endangered and Proposed Wildlife Species documented to occur in the Middle River Project Area.

Threatened, Endangered and proposed wildlife species that have suitable habitat in the Middle River Breaks portion of the Oak-Hickory Hills LTA and may occur in the Middle River Project Area:

Gray Bat (*Myotis grisescens*): The nearest Gray bat cave (transitory) is located approximately 15 miles west of the Middle River Project area. Gray bats migrate each year between their summer and winter caves. Gray bats also have very specific cave requirements (less than five percent of the caves are suitable for the gray bat). These bats prefer to forage over water. During the summer months the caves used by females (maternity caves) are usually located within 0.6 miles of a river or lake (1999, U.S. Fish & Wildlife Service Biological Opinion on the Mark Twain National Forest).

Several Gray bats were found in the Middle River Project Area along Middle River itself, during surveys conducted in 2003. The bats were caught in mist nets near Middle River. One Gray bat was outfitted with a radio transmitter. This bat was tracked for 3 nights. It was only found on Forest Service lands during the first night (Amelon, 2003).

Indiana Bat (*Myotis sodalis*): During the winter months Indiana bats hibernate in caves and abandoned mines. During the summer months Indiana bats are found predominately in forested areas near water. Female Indiana bats crawl under the peeling bark of large trees to have their young. Maternity roost sites are usually located in areas with 60 to 80% canopy cover (1999 U.S. Fish Wildlife Service Biological Opinion 1999, page 42). Indiana bats forage in and around the tree canopy for flying insects. A 50-70% canopy closure is ideal for Indiana Bat foraging (Indiana bat section of the Mark Twain National Forest Programmatic Biological Assessment 1998, page 17). This is because the bats can move more easily between the trees and there is a greater habitat diversity compared to a mature canopy; therefore a greater abundance of insects exists.

Indiana bats have been declining recently due to human disturbance at their hibernating sites, loss of large trees with peeling bark that provide roosting sites, pesticide use and their naturally low birth rate. Indiana Bats utilize flood plains and riparian forests during the summer. Primary roosts are located in openings or

the edge of forest stands (1999, U.S. Fish & Wildlife Service Biological Opinion for the Mark Twain National Forest).

Within the Middle River Project Area, there are no documented Indiana bats or caves utilized by Indiana bats. There are two caves documented to have Indiana bats over 14 air miles north and west of the Middle River project area. These caves do not occur on National Forest System lands.

The nearest documented capture site of a reproductively active female Indiana Bat is approximately 70 air miles southeast of the Middle River Project Area. The nearest documented active Indiana bat maternity colony is located over 70 air miles to the east. No Indiana bats were found in the Middle River Project Area during surveys conducted in 2003.

Threatened, Endangered and proposed wildlife species that have suitable habitat in the Oak Hickory Hills LTA, but not the Middle River Breaks portion of the Oak Hickory Hills LTA, but may pass thru the Middle River Project Area:

Bald Eagle (*Haliaeetus leucocephalus*): There are no documented active bald eagle nests or roosts on the Cedar Creek Unit of the Mark Twain National Forest. Currently Bald eagle numbers are rising statewide and on the MTNF.

Bald eagles generally utilize larger heavy branched trees within 100-600 feet of water for perch sites (1999, U.S. Fish & Wildlife Service Biological Opinion on the Mark Twain National Forest). Bald eagles usually are found adjacent to larger bodies of water such as rivers and lakes. (There are no large bodies of water in the Middle River Project Area). The nearest documented communal Bald eagle night roost is located over 70 air miles west of the Middle River Project Area. The nearest documented Bald eagle nest is approximately 40 air miles southeast of the Middle River Project Area. The Middle River Project Area is completely surrounded by farms and roads. However it is possible that a Bald eagle may pass through the Middle River Project Area.

Threatened, Endangered and Proposed wildlife species that do not occur or have habitat in the Middle River Project Area including the Middle River Breaks portion of the Oak-Hickory Hills LTA.

These species include the Curtis' pearly mussel, Pink mucket pearly mussel, Scaleshell mussel and Hine's emerald dragonfly. Since there would be no effect to these species they will not be discussed any further in this document.

Direct and Indirect Effects on Threatened, Endangered and Proposed Wildlife Species by Alternative

Gray Bat

Alternative 1 (No Action):

The indirect effect is that there would be no watershed improvements in the riparian habitat that the Gray bat utilizes. Therefore there would be no long-term reduction in sediment production in the area.

Items common to all action alternatives (Alternative 2 and 3):

The intensity of the prescribed fires would be minimal, and thereby maintain any existing Gray bat habitat. Smoke from prescribed fires could result in the temporary displacement of individuals.

An indirect effect is the following watershed improvements would occur: hardwood plantings in the riparian area along Middle River, road closures of temporary and non-system roads, reducing erosion at an existing drainage crossing and installation of erosion control structures. These projects would reduce sedimentation in the long term and improve the riparian habitat. Because Gray bats utilize riparian corridors, these watershed type projects would benefit gray bats. These alternatives contain some timber harvest. However, no timber harvest would occur in riparian areas.

Indiana Bat**Alternative 1 (No Action):**

Where an existing dense canopy occurs, bat movement would continue to be hindered, since a 50-70% canopy is ideal for Indiana bat foraging.

Items common to all action alternatives (Alternative 2 and 3):

Smoke from prescribed fires could result in the temporary displacement of individuals. The intensity of the prescribed fires would be minimal, and thereby maintain any existing Indiana bat habitat. Some potential roost trees could be destroyed and/or created by the prescribed fires.

Alternative 2 and 3:

The long-term indirect effect is that many of the existing white oak and shagbark hickories (potential roost trees) would have increased growth rates because there would be less competition for light, water and nutrients from the surrounding trees. However, some potential roost trees may be lost as a result of logging. All dead trees greater than or equal to 20 inches would be retained. In addition, all live trees greater than or equal to 26 inches would be retained. Uneven-aged management would reduce the existing dense canopy closure and move it toward the 50-70% canopy closure that is ideal for Indiana bat foraging. This benefit would diminish once those canopies grow together and the canopy closure again exceeds 70%. *These follow the Terms and Conditions outlined on page 76 - 81 of the 1999 U.S Fish Wildlife Service Biological Opinion.*

Bald Eagle**Alternative 1(No Action):**

The indirect effect is that there would be no watershed improvements. Without riparian plantings near Middle River, there would not be future forests in this area. Existing sediment would occur and lack of shade would continue, which could impact the Bald eagles' fish prey base.

Items common to all action alternatives (Alternative 2 and 3):

Smoke from prescribed fires could result in the temporary displacement of individuals. The intensity of the prescribed fires would be minimal, and thereby maintain any existing Bald eagle habitat and any potential nest or roost trees.

The following watershed improvements would occur: riparian hardwood plantings in the riparian area along Middle River, road closures of temporary and non-system roads, reducing erosion at an existing drainage crossing and installation of erosion control structures. These projects would reduce

sedimentation in the long term and improve the riparian habitat and therefore improve the habitat for the Bald eagles fish prey species.

Alternative 2 and 3:

Both alternatives contain timber harvest. However, no timber harvest would occur in riparian areas where potential perch, roost or nest trees would occur.

Cumulative Effects on Threatened, Endangered and Proposed Wildlife Species

The cumulative effects definition for Threatened and Endangered species utilized here is the National Environmental Policy Act (NEPA) (40 CFR 1508.7) definition. In NEPA the cumulative effects considers future federal actions.

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Items common to all T&E species:

This includes fire suppression, prescribed fire, wildfire, various recreational activities, timber harvest, timber stand improvement, livestock grazing, wildlife and fish habitat improvements, road construction and reconstruction and road closures on federally owned and private lands. It also includes land clearing for farms and/or home sites and on private land.

Gray Bat: A wildfire or prescribed fire could temporarily displace any Gray bats in the Middle River area. There would be temporary cumulative effects on bat habitat overall from smoke and increased human activity in the Middle River Project Area. However, these would be minimal. Some potential bat foraging habitat could be lost as a result of land clearing for agriculture and/or home sites in riparian areas on private lands. Pesticide use would continue on private lands; thereby potentially effecting insectivorous bat populations.

Indiana Bat: A wildfire or prescribed fire could temporarily displace any Indiana bats. A wildfire could occur on Forest Service or private lands, which could destroy and/or create some potential roost trees. There are temporary cumulative effects on bat habitat overall from increased human activity in the area. However, these would be minimal. Some potential Indiana bat foraging and/or roosting habitat could be lost as a result of land clearing for agriculture and/or home sites on private lands. Pesticide use would continue on private lands; thereby potentially effecting insectivorous bat populations.

Bald Eagle: There is a potential effect of smoke from a wildfire or a prescribed fire that could temporarily displace any Bald Eagles that may pass through the Middle River Project Area. Some potential Bald eagle habitat perch sites could be lost as a result of land clearing for agriculture and/or home sites on private lands.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

• Regional Forester Sensitive Wildlife Species

Existing Conditions

The National Forest Management Act (NFMA) regulations of 36CFR 219.19 specify that fish and wildlife habitat will be managed to maintain viable populations of existing native and desired non-native species. This requirement is further developed in Chapter 2670 of the Forest Service Manual, which establishes a “Sensitive” category to include animal, plant, and fish species in addition to indicator species whose viability is a concern to the Forest Service. The objective is to ensure that these species do not become threatened and endangered because of Forest Service actions. The February 29, 2000 (including October 23, 2003 list update) Forest Service R-9 Regional Forester Sensitive Species (RFSS) list is utilized. *Note: Additional information is contained in the Biological Evaluation for RFSS species in Appendix G.*

Sensitive wildlife species that are documented to occur in the Middle River Project area:

There are no documented wildlife RFSS species in the Middle River Project Area.

Sensitive wildlife species that have suitable habitat in the Middle River Breaks portion of Oak-Hickory Hills LTA and may occur in the Middle River Project Area:

Cerulean Warbler (*Dendroica cerulea*): The Cerulean warbler is a Neotropical Migrant Bird. The Cerulean warbler is found in oak hickory forest in bottomlands and riparian areas. The nest is built 18-60 feet off the ground. The nesting season is between May and June. This species is usually found in large tracts of bottomland forest (usually 250+ Ha.). No large tracts of bottomland forest occur in the Middle River Project area or on the Cedar Creek Unit of the Mark Twain National Forest.

Sensitive wildlife species which are not likely to occur in the Middle River Project area (including the Middle River Break portion of the Oak-Hickory Hills LTA) due to a lack of suitable habitat:

This includes the A heptagenid mayfly, Migrant Loggerhead shrike, Bachman's sparrow, Cavernicolous harvestman, Central Missouri cave amphipod, Eastern small spotted bat, Spectacle case naiad, Ouachita kidneyshell, Onondaga cave amphipod, Peregrine falcon, Bluff vertigo snail, Eastern Hellbender, Ozark Hellbender, Ozark snaketail, Alligator Snapping turtle, Salem cave crayfish, Swainson's warbler, Tumbling Creek cavesnail, Western fanshell, Purple lilliput, Greer Springs micro-caddisfly, A Springtail (*Pseudosinella espana*), Dimorphic isopod, Coldwater crayfish, Meek's crayfish, Big Creek crayfish, and the White River crayfish.

Note: Because these Sensitive wildlife species and their habitat do not occur in the Middle River Project Area including the Middle River Breaks portion of the Oak-Hickory Hills LTA they will not be discussed any further in this document.

Direct and Indirect Effects on Regional Forester Sensitive Wildlife Species by Alternative

Cerulean Warbler

Alternative 1 (No Action):

There would be no change and/or improvement to the existing small amount of bottomland hardwood habitat because no tree planting in the riparian would occur in this Alternative.

Items common to all action alternatives (Alternative 2 and 3):

The intensity of the prescribed fires is not enough to permanently alter any riparian bottomland hardwood habitat. These alternatives would plant hardwood trees on approximately 8 acres of bottomland hardwoods, improving the habitat in the long-term. No removal of forest products would occur in the bottomland hardwood habitat where this species may be found.

Cumulative Effects on Regional Forester Sensitive Wildlife Species

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Cerulean Warbler:

Some bottomland hardwood habitat would continue to be lost on private lands due to land clearing for agriculture and/or home sites. Bottomland hardwoods would continue to be planted on Forest Service managed lands, improving long-term habitat for this species. A wildfire could occur on either Forest Service or private lands, which could temporarily alter some riparian bottomland habitat. The species could be temporarily displaced and/or a nest could be inadvertently destroyed by a wildfire.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

Management Indicator Species**Existing Conditions**

Management Indicator Species (MIS) were selected for the Mark Twain National Forest during forest planning in accordance with CFR 219.19. The selected MIS are resident species (yearlong or migrant) that are ecological indicators and are an indicator of management activities (both positive and negative).

The MIS for the Oak-Hickory Hills LTA include the: Pileated woodpecker, ovenbird, turkey, white-tailed deer, raccoon, bobwhite quail, orchid oriole, wood thrush, ruffed grouse, bobcat, indigo bunting, eastern bluebird and cottontail rabbit (LRMP, pg. IV-58).

The MIS are representatives for estimating the effects of forest management on populations of other species. The needs of these species range from open lands to old growth forests. Some of the species have very specific habitat requirements, while others are considered to be generalists, which may utilize a range of habitats. The MIS for cavity trees and snags are the Pileated woodpecker, Indigo bunting, Eastern Bluebird and Raccoon.

In Missouri most of the species that require more open type habitats have declined slightly due to a loss in openings. Most of the species that require mature or old growth type habitat have increased slightly as Missouri's forests continue to mature. Population monitoring information is displayed with each individual

species (Mark Twain National Forest, Monitoring Report of Population trends of MIS species found on the Mark Twain National Forest. October 1, 2002. pg. 2).

Pileated Woodpecker

The Pileated woodpecker is a large woodpecker and is an indicator of old growth and snags. It is a primary cavity nester (other species utilize the old Pileated woodpecker cavities) that excavates its' nests in larger diameter trees. Pileated woodpeckers will utilize smaller trees for foraging. The height of their nest is between 15 and 70 feet. The nesting season occurs between late April and May. In Missouri, the Pileated woodpecker numbers have increased 1.0 percent between 1980 and 2001. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Ovenbird (Neotropical Migrant Bird)

The Ovenbird is a ground nester that prefers areas of dense, medium-sized timber with an 80-90 percent canopy closure that has a thick layer of leaf litter. The primary nesting season is between late May and early July. In Missouri, the Ovenbird numbers have increased 2.2 percent between 1980 and 2001. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Turkey

The turkey is found in a variety of habitats, but prefers a mosaic of timbered and open habitats. The turkey is also an important game species. The turkey is an omnivore, eating a wide variety of items from insects to nuts. The turkey is a ground nester that roosts in trees. The Houston/Rolla/Cedar Creek District contains some of the largest turkey populations in the state (based on gobblers per square mile). The primary nesting season for this bird is between mid April and July. In Missouri, the wild turkey numbers have shown a slight increase between 1980 and 2001.

The Breeding Bird Survey is conducted in late May and early June, after the turkey nesting season is completed. Therefore the survey method is not always well suited to capture information on breeding turkeys. Another method of estimating population trends in Missouri is through the analysis of harvest information, which shows that the turkey population is steady after a relatively large population increase in the mid 1990's. In 1998, Missouri added one week to the spring turkey hunting season. Each year has set a record or near record annual harvest numbers. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

White-tailed Deer

The White-tailed deer is an important game species. It is also an indicator of a mosaic of habitats from openings to dense forests. It is also well adapted to human populations and is even found living within cities. In Missouri, the white-tailed deer numbers are stable. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Raccoon

Raccoons predominately nest in cavities of dead and dying trees. They occur in a large variety of habitats from fields to forests and even cities. In forested areas acorn mast is a primary source of food in the fall and winter months. The Raccoon is an omnivorous species that often eats bird eggs. In Missouri, the raccoon population trend is stable and at high population levels. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Bobwhite Quail

The Bobwhite Quail is usually found in prairies and grasslands along the edge of forests. Because of declining habitat, their numbers have been declining recently. The Bobwhite Quail form tight coveys at night with everyone facing outward. This way they conserve heat at night and it is very difficult for predators to sneak up on a covey. They usually nest along the edge of woods or a field, in tall grass or brush piles. The primary nesting season for this bird is between March and September. In Missouri, the Bobwhite Quail numbers have declined 3.5 percent between 1980 and 2001. This decline in the population is not surprising given that many other prairie and grassland species numbers are declining in Missouri, the Midwest and other portions of the Country.

Orchard Oriole (Neotropical Migrant Bird)

The Orchard Oriole is generally found in open woodlands and in oak savannas. It does not utilize dense forests. This species nests in shrubs and in trees. The primary nesting season is between May and later July. In Missouri, the Orchard oriole population trend has declined 0.6 percent between 1980 and 2001. Currently there are no viability concerns for this species in Missouri or on the Mark Twain National Forest.

Wood Thrush (Neotropical Migrant Bird)

The Wood thrush is often found in mixed pine/hardwood stands near riparian areas. It is found in a variety of forest habitats predominately over 50 years old. It nests in trees at height between 2 and 35 feet. The primary nesting season for this bird is between April and August. In Missouri, the Wood thrush numbers have increased 4.2 percent between 1980 and 2001. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Ruffed Grouse

The Ruffed grouse is a indicator of early succesional stages. There are no documented ruffed grouse in the Middle River Project Area and this portion of the Mark Twain National Forest. During the 1980's the state of Missouri released Ruffed Grouse on the Mark Twain National Forest, however the success of these releases is undocumented (personal communication with Garry Houf , retired USFS Wildlife Biologist, 2000). The Mark Twain National Forest does lie within Ruffed grouse habitat within Missouri. There may be scattered individuals in southern Missouri counties. A breeding population of Ruffed Grouse only occurs in some central Missouri counties. These areas do have an established hunting season. Viability concerns for this species center around the lack of early successional forest habitat and possibly other predation or weather factors. The primary nesting season for this bird is between April and June. In Missouri, the Ruffed Grouse has declined slightly over the past 5 years.

Bobcat

The bobcat is found in variety of habitats however these habitats are usually associated with shrubby country or open woodlands. It uses a wide variety of sites for its den. Den sites include tree cavities, underground burrows, rocky cliffs and caves. In Missouri, the Bobcat numbers have been stable for the past 5 years. In the Missouri Ozark's, the Bobcat population is stable. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Indigo Bunting (Neotropical Migrant Bird)

The Indigo bunting is an indicator of deciduous forest edge habitat. It is not found in mature forests. It nests predominately in small bushes. The primary nesting season for this bird is between May and July. In

Missouri, the Indigo bunting numbers have increased 0.4 percent between 1980 and 2001. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Eastern Bluebird (Neotropical Migrant Bird)

The Eastern bluebird is an indicator of snags and cavities. They often utilize old cavities excavated by woodpeckers. Starlings and house sparrows may also utilize these same holes. It is also associated with more open areas. The primary nesting season for this bird is between mid April and July. This species readily adapts to artificial nesting structures such as bluebird boxes. In Missouri, the Eastern bluebird numbers have increased 1.3 percent between 1980 and 2001. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Cottontail Rabbit

The Cottontail rabbit is found in a wide variety of habitats (including cities). However they are usually found in or near openings. In Missouri, the Cottontail rabbit numbers are stable on the Ozark Plateau. Currently there are no viability concerns for this species in the State of Missouri or on the Mark Twain National Forest.

Direct and Indirect Effects on Management Indicator Species by Alternative

Note: See the Neotropical Migrant Bird section for the Ovenbird, Orchard Oriole, Wood Thrush, Indigo Bunting and the Eastern Bluebird all of which are Neotropical Migrant Birds.

Pileated woodpecker**Alternative 1 (No Action):**

No potential den or foraging trees would be removed via timber harvest or prescribed burning in this alternative, therefore no Pileated Woodpecker habitat would be affected, allowing bird numbers to remain stable.

Items common to Alternatives 2 and 3:

The intensity of the proposed prescribed burn is not enough to permanently impact and modify Pileated Woodpecker habitat. The burning would occur prior to this species' nesting season. Some snags could be created and/or destroyed by the prescribed burns. However, smoke may result in the temporary displacement of individuals.

These alternatives may remove some potential den or foraging trees by timber harvest. However the Forest Plan set aside standards for snag and den trees would be adequate for this species.

Ovenbird

Alternative 1 (No Action): None of the leaf litter required by this species for nesting would be removed, unless a wildfire occurs in the project area. Therefore, ovenbird habitat would not be affected in this alternative and ovenbird habitat should remain stable.

Items common to Alternative 2 and 3:

Prescribed burning would occur prior to the nesting season of the ovenbird. However, smoke from prescribed fires could temporarily displace some birds. In some areas prescribed burning would also temporarily reduce the leaf litter that this species requires.

Some trees would be removed in these alternatives, which would result in a temporary decrease in the amount of available leaf litter.

Turkey:**Alternative 1 (No Action):**

As a result of fire suppression, the existing amount of semi-open habitat would continue to decline due to plant succession. Grazing, which would help to maintain some of the areas openings, would continue. No prescribed burning in woodlands, which would maintain some of the areas openings, would occur. These activities could improve or reduce turkey populations in the area.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the beginning of the nesting season for the turkey. However, smoke from prescribed fires could temporarily displace some birds. Prescribed fire would help to maintain the mosaic of habitats that the turkey requires. The maintenance of open woodlands and early successional habitat by utilizing timber harvest (including firewood removal) to open up these areas would occur. This would benefit this species. The use of herbicides would help to control fescue in certain areas. Fescue does not provide turkey habitat, therefore the use of herbicides would temporarily help turkey habitat (until the planted trees become well established).

Alternative 2: This alternative would burn 400 acres. Approximately 460 acres would be partially opened with uneven-aged timber harvest. These activities would benefit turkey habitat.

Alternative 3: This alternative would burn 430 acres. Approximately 460 acres would be partially opened with uneven-aged timber harvest. These activities would benefit turkey habitat.

White-tailed deer**Alternative 1 (No Action):**

No timber harvest, which would help to maintain a mosaic of habitats, would occur. Therefore, the deer population could be negatively affected.

Items common to Alternatives 2 and 3:

There may be a temporary direct effect from smoke and increased human activity in the area that may result in the temporary displacement of individuals. Prescribed fire would help to maintain the mosaic of habitats required by this species.

The maintenance of open woodlands and early successional habitat by utilizing timber harvest to open up these areas would benefit this species.

Raccoon**Alternative 1 (No Action):**

As trees continue to mature and/or die, additional cavities would continue to be produced, improving habitat for the raccoon.

Items common to Alternatives 2 and 3:

The prescribed fires proposed in these alternatives would have a low intensity. However, there is a very slight potential that some den trees could be destroyed and/or created. The smoke could result in the

temporary displacement of individuals. The vegetative removal in these alternatives could remove some potential den trees. However, the Forest Plan set aside standards for snag and den trees would be adequate for this species.

Bobwhite Quail

Alternative 1 (No Action):

No direct effects are expected. However, an indirect effect is that succession would continue, resulting in a decline in potential Bobwhite Quail habitat.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the majority of the nesting season for the Bobwhite quail. If a nest would be destroyed, the Bobwhite quail would most likely re-nest during the same year. There may be a temporary direct effect from smoke and increased human activity in the area that may result in the temporary displacement of individuals. The maintenance of forest edge habitat, by utilizing prescribed fire to open up these areas, would benefit this species. The use of herbicides would help to control fescue in certain areas. Fescue does not provide turkey habitat, therefore the use of herbicides would temporarily help turkey habitat (until the planted trees become well established).

The creation of forest edge habitat by utilizing timber harvest to open up some small areas would benefit this species.

Orchard Oriole

Alternative 1 (No Action):

None of the denser forests would be opened up by timber harvest. Therefore, habitat is not being improved for the Orchard Oriole.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the beginning of the nesting season for the Orchard oriole. However prescribed burning could temporarily reduce the shrub habitat that this species utilizes. There may be a temporary direct effect from smoke that may result in the temporary displacement of individuals. Prescribed fire would help to maintain the more open habitat that this species requires. Firewood removal and timber removal would help to maintain the more open habitat that this species requires.

Wood Thrush

Alternative 1 (No Action):

The forests would continue to mature, therefore improving the habitat for this bird in this alternative.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the majority of the Wood thrush nesting season. If a nest would be destroyed, the Wood thrush would most likely re-nest during the same year. The intensity of the proposed prescribed burn is not enough to permanently impact and modify their habitat itself. Therefore the prescribed burning in these alternatives would maintain the amount of existing mature forested habitat. Timber harvest could temporarily remove some of their potential habitat.

Ruffed Grouse**Alternative 1 (No Action):**

No prescribed burning or vegetation removal that could maintain and/or improve their habitat would occur.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the majority of the nesting season for the Ruffed grouse. If a nest would be destroyed, the Ruffed grouse would most likely re-nest during the same year (however, no Ruffed grouse are known to occur on the Cedar Creek Unit). The intensity of the proposed prescribed burn is not enough to permanently impact and modify their habitat itself. The prescribed burns and timber harvest within woodlands would help to temporarily maintain the early successional habitats that this species requires. The maintenance and/or creation of early successional habitats would benefit this species.

Bobcat**Alternative 1 (No Action):**

No direct effects are expected.

Items common to Alternatives 2 and 3:

There may be a temporary direct effect from smoke and/or increased human activity from proposed activities that may result in the temporary displacement of individuals. The intensity of the proposed prescribed burn is not enough to impact and modify their habitat. Therefore, these alternatives would maintain the amount of existing habitat.

The proposed vegetative removal through timber harvest would not reduce the amount of potential Bobcat habitat. However it could result in the temporary displacement of individuals.

Indigo Bunting**Alternative 1 (No Action):**

No direct effects are expected. However, as forests continue to mature some of the edge habitat that this species requires would be lost.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the beginning of the nesting season for Indigo bunting. Therefore, no nests would be destroyed by prescribed fire. There may be a temporary direct effect from smoke and increased human activity in the area that may result in the temporary displacement of individuals. The maintenance of forest edge habitat by utilizing prescribed fire to open up these areas would benefit this species.

Alternative 2 and 3: The maintenance and/or creation of deciduous forest edge habitat would benefit this species. This would be accomplished by utilizing timber harvest.

Eastern Bluebird**Alternative 1 (No Action):**

No potential snags and/or cavity trees would be removed by timber harvest, therefore existing habitat would be retained and benefit this species.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the beginning of the nesting season for the eastern bluebird. The intensity of the proposed prescribed burn is not enough to impact and modify their habitat itself. Therefore, these alternatives would maintain the amount of existing habitat. There may be a temporary direct effect from smoke that may result in the temporary displacement of individuals.

These alternatives may remove some potential snags and/or cavity trees via timber harvest. However the Forest Plan standards for snag and den trees would be adequate for this species.

Cottontail Rabbit**Alternative 1:**

No direct effects are expected.

Items common to Alternatives 2 and 3:

The intensity of the proposed prescribed burn is not enough to impact and modify their habitat. Therefore these alternatives would maintain the amount of existing habitat. There is a possibility that some animals could be temporarily disturbed and displaced by the smoke and flames. However, their food source would be improved as a result of the prescribed fires.

The cottontail rabbit's food supply and habitat would be increased in areas where timber harvest opens up the first canopy and allows more sunlight to reach the forest floor. Slash from timber harvest would result in a temporary increase in ground cover. However, opening up the forest canopy would make the cottontail more susceptible to predators such as hawks and owls in some areas.

Cumulative Effects on Management Indicator Species

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Pileated Woodpecker

Fire suppression has resulted (and would result) in an increase of the Pileated Woodpecker's habitats. Land clearing for agriculture and home sites on private lands has resulted in the loss of habitat for these species. Some snags or den trees could be removed by timber harvest or firewood cutting on Forest Service and/or private lands in the future. Wildfire could occur on Forest Service or private lands, which could potentially impact some Pileated Woodpecker habitat by destroying and/or creating snags utilized by this species. Smoke may temporarily displace this species.

Raccoon

Fire suppression has resulted (and would result) in an increase of the raccoon's habitats. Land clearing for agriculture and home sites on private lands has resulted in the loss and/or created habitat for these species. A wildfire could occur at any time on either private or Forest Service lands. A wildfire could potentially destroy and/or create the dead and dying trees this species utilizes.

Turkey

Fire suppression has resulted (and would result) in a decline of the turkey's habitats. Land use conversions to agriculture and/or home sites on private lands have resulted in the loss of habitat for this species. These same activities often result in a greater use of pesticides in order to maintain weed and insect-free fields and/or lawns. This has a negative impact on this species habitat and populations. The use of herbicides would help to control fescue in certain areas. Fescue does not provide turkey habitat, therefore the use of herbicides would temporarily help turkey habitat (until the planted trees become well established). A wildfire could occur at any time. The smoke and/or flames could result in the temporary displacement of individuals. A wildfire may destroy some nests, however the turkey would most likely re-nest during the same year. A wildfire would help maintain some of the open areas this species requires and create a mosaic of habitats.

Converting non-native fescue fields to warm season grasses would benefit turkey and/or their habitat. Utilizing grazing, prescribed burning, and mowing would help to maintain open areas benefiting this species.

White-tailed Deer and Cottontail Rabbit

Timber harvest would help to maintain the mosaic of habitat these two species require. Conversely, fire suppression has resulted in a decline of their habitats. Both species are well adapted to people and often live near and/or in populated areas. A wildfire could occur at any time. Smoke and/or flames could result in the temporary displacement of individuals. Timber harvest could temporarily disturb these species. A wildfire would temporarily maintain the mosaic of openings and forests that this species requires.

Bobwhite Quail

A wildfire could occur at any time and could temporarily impact this species. A fire could destroy Bobwhite Quail nests. An intense fire could create additional habitat by creating openings along the edge of woods. Timber harvest has resulted in an increase of their habitats. Conversely, fire suppression has resulted in a decline of their habitats. The use of herbicides would help to control fescue in certain areas. Fescue does not provide turkey habitat, therefore the use of herbicides would temporarily help turkey habitat (until the planted trees become well established). Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for this species (especially in areas where old windrows were removed). Converting timbered areas or fields to lawn on private land does not provide habitat for this species. This land clearing often results in the introduction of feral cats and a greater use of pesticides, both of which may negatively impact this species population.

Ovenbird

Fire suppression has resulted in an increase of the Ovenbird's habitat. A wildfire could occur at any time. The smoke and/or flames could result in the temporary displacement of individuals. A wildfire could destroy some of the thick leaf litter this species requires. In addition, it could destroy the ground nest of this species. Timber harvest on either Forest Service lands or private lands adjoining the Project Area may result in a temporary decrease in the leaf litter this species requires. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for these species. This clearing for home sites often results in increased nest predation by Brown headed cowbirds, the introduction of feral cats and a greater use of pesticides. All of these actions may negatively impact this species population.

Wood Thrush

Fire suppression has resulted (and would continue to result) in an increase of their habitats. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for these species. This land use conversion often results in increased nest predation by Brown headed cowbirds, the introduction of feral cats and a greater use of pesticides; all of which may negatively impact this species population. A wildfire could occur at any time. A hot and intense wildfire could potentially impact some wood thrush or their habitat. It could destroy nests and/or destroy habitat utilized by this species. Smoke and/or flames may result in the temporary displacement of individuals. Some trees, which could potentially provide nest sites for the Wood Thrush, could be lost by timber harvest. No timber harvest would occur in riparian areas on Forest Service lands in the Project Area.

Eastern Bluebird

Fire suppression has resulted in an increase of the cavity habitat that this species requires. However, fire suppression has also resulted in a decrease in the openings that the Eastern Bluebird also requires. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of some of the cavity habitat that this species requires. Conversely, this land clearing also creates some of the open areas that this species also requires. These same activities often result in increased nest predation by Brown headed cowbirds, the introduction of feral cats and a greater use of pesticides; all of which may negatively impact this species population. A wildfire could occur at any time, which could potentially impact some habitat. It could destroy nests and/or destroy habitat utilized by the Eastern Bluebird. Smoke and/or flames may result in the temporary displacement of individuals.

Some potential snags and cavity trees could be removed as a result of timber harvest or firewood cutting on both Forest Service and private lands. This could result in a decrease of the cavity habitat required by this species.

Orchard Oriole and Indigo Bunting

Fire suppression has resulted (and would continue to result) in a decline of the Orchard Oriole and Indigo Bunting's habitats. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for these species. This same land clearing often results in increased nest predation by the Brown headed cowbirds, the introduction of feral cats, and a greater use of pesticides, all of which may negatively impact this species population. A wildfire could occur at any time; smoke and/or flames could result in the temporary displacement of individuals and/or destroy nests. An intense fire could create additional habitat by opening up dense forests.

Uneven-aged timber harvest and/or prescribed fire would create the more open woodlands or edge required by these species, benefiting them in the long term.

Ruffed Grouse

Timber harvest where there is no land use conversion has resulted in an increase of the Ruffed Grouse's habitats. Conversely, fire suppression over a prolonged period of time (>20 years) has resulted in a decline of their habitats. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for these species. A wildfire could occur at any time, which could potentially impact some Ruffed Grouse habitat. However, it would also create the early successional habitats this species utilizes. *Note: The Ruffed Grouse is not known to occur in the Middle River Project Area or on the Cedar Creek Unit of the Mark Twain National Forest.*

Bobcat

Some timber harvest has resulted in an increase of the Bobcat's habitats. Conversely, fire suppression has resulted in a decline of their habitats. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for this species. These same activities often result in increased human activity in the area, therefore, increasing the risk of accidental shootings of this species. A wildfire could occur on either Forest Service or private lands, which could potentially impact Bobcat habitat by killing trees or creating cavities in trees that the bobcat utilizes. The smoke and the increased human activity may also result in the temporary displacement of animals. Coyote populations also are a factor in limiting Bobcat populations.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

- **State of Missouri Endangered Species**

Existing Condition

The March 1, 2003 State Endangered Species List (section 3CSR10-4.111 of the Wildlife Code of Missouri) was utilized in the preparation of this section. The Forest Service addresses all State of Missouri Endangered species.

State of Missouri Endangered wildlife species that are documented to occur in the Middle River area:

There are no documented State of Missouri Endangered wildlife species in the Middle River area.

State of Missouri Endangered wildlife species that have suitable habitat in Callaway County and are documented to occur in Callaway County:**Bald Eagle and Gray Bat:**

(See the Threatened, Endangered and Proposed wildlife species section).

American Bittern (*Botanrus lentiginosus*):

This species is usually found in marshes and nests close to water. The nests are usually located 2-8 inches above water. The Breeding season for the American bittern is from late April to May. It prefers cattails, bulrush or sedges.

Greater Prairie Chicken (*Tympannchus cupido*):

This species is usually found in native prairie tracts larger than 160 acres (65 Ha) with legumes or warm season grasses. The breeding season is from mid-March to late May. However, the males have been observed on the booming grounds from January until mid-June. The prairie chicken is a ground nester. Currently the Middle River Project Area does not provide any potential Greater prairie chicken habitat (there are not enough large warm season fields in the area).

Barn Owl (*Tyto alba*):

The barn owl is known to occur in Callaway County. The barn owl is found in variety of open habitats. For nesting it utilizes barns, sheds, dry caves or cavities in trees. It may have several broods annually (depending on the availability of food). This species readily adapts to human activity. It has been found to nest in barns and old buildings.

Northern Harrier: (*Circus Cyaneus*)

The Northern Harrier is found in a variety of open areas (including wetlands or other moist areas). It is a ground nester and utilizes grasses and sticks in its nest construction. The nests are built from mid-April to mid-May. This species prefers isolation from humans. It is also a winter resident of Missouri.

State of Missouri Endangered wildlife species that are not documented to occur in the Middle River Project area (including Callaway County) due to a lack of suitable habitat:

This includes the Ozark big eared bat, Bachman's sparrow, Indiana bat, Interior least tern, Peregrine falcon, Swainsons warbler, American burying beetle, Ebonyshell, Fat pocketbook, pink mucket, Kingrail, Snowy Egret, Elephant Ear, Black-tailed Jackrabbit, Mountain Lion, Eastern massasauga, Snuffbox, Higgins eye mussel, Curtis Pearly mussel, King rail, Eastern spotted skunk, Mississippi green water snake, Western fox snake, Blanding's turtle, Illinois mud turtle, Western Chicken turtle, Yellow mud turtle and the Hines Emerald dragonfly. *Note: Because these State Endangered species and their habitat does not occur in the Middle River Project Area (including Callaway County) they will not be discussed any further in this document.*

Direct and Indirect Effects on State of Missouri Endangered Species by Alternative**American Bittern****Items common to all alternatives (Alternative 1 - 3):**

None of the alternatives propose to drain any wetlands that this species requires therefore there would be no effects to this species.

Alternative 2 and 3:

Alternative 2 and 3 propose to breach and lower one existing pond. However this pond currently does not provide any potential habitat, therefore there would be no negative effects resulting from breaching and lowering this pond.

Greater Prairie Chicken**Items common to all alternatives (Alternative 1 - 3):**

There would be no direct effect because the Middle River area does not provide any potential Greater Prairie Chicken habitat. All alternatives would help to maintain the existing warm season fields.

Barn Owl**Alternative 1:**

No direct effects are expected.

Items common Alternatives 2 and 3:

The intensity of the proposed prescribed burn is not enough to impact and modify Barn owl habitat. Therefore, these alternatives would maintain the amount of existing habitat. However, the smoke may temporarily cause individual birds to move.

The vegetative removal in these alternatives could remove some cavity trees. However, the Forest Plan standards for snag and den trees would be adequate for this species.

Northern harrier**Alternative 1:**

The open areas utilized by this species would continue to be lost as succession continues.

Items common to all alternatives:

Livestock grazing and the human activity associated with it could temporarily disturb any Northern Harrier. Mowing activity in the area would occur after the nesting season.

Items common to Alternatives 2 and 3:

Prescribed burning would occur prior to the beginning of the nesting season of the Northern harrier. However, smoke from prescribed fires could temporarily displace some birds. In some areas prescribed burning would temporarily reduce the amount of grasses and sticks that this species requires for its nest construction. Mowing activity in the area would occur after the nesting season.

The openings created by timber harvest would not likely create the short grass habitat that this species requires.

Cumulative Effects on State of Missouri Endangered Species

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

American Bittern

The filling of and/or draining of wetlands or wet areas has resulted in the loss of some American bittern habitat. Land use conversions to row crops or home sites also results in a loss of this species habitat.

Greater Prairie Chicken

Fire suppression would continue to result in a decline in this species' habitat. A wildfire could occur at any time. Smoke may result in the temporary displacement of individuals. An intense fire could create additional habitat by opening up dense forests or maintain grasslands. However, it could also potentially destroy some dens that are built in ground depressions or cause individual animals to move. The loss of prairie habitat due to land conversion on private lands is also a concern.

Barn Owl

A wildfire could occur at any time. Smoke and/or flames may result in the temporary displacement of individuals. An intense fire could create additional habitat by opening up dense forests. However, it could also destroy some cavity trees. Land clearing on private lands for agriculture and/or home sites has resulted in the maintenance or increase of habitat for these species.

Northern Harrier

The filling of and/or draining of wetlands or wet areas on private lands has resulted in the loss of some Northern Harrier habitat. Fire suppression has resulted in a decline of their habitats. The introduction of feral cats on private land may also impact this species. A wildfire could occur at any time; smoke and/or flames could result in the temporary displacement of individuals. An intense fire could create additional habitat by opening up dense forests. However, it could also destroy some nests. There is a potential that increased human activity from fire suppression activities may temporarily impact this species.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

- **Neotropical Migrant Birds**

Existing Condition

Note: Additional information on the Ovenbird, Wood Thrush, Indigo Bunting and the Eastern Bluebird, which are Management Indicator Species and Neotropical Migrant Birds, can be found earlier in this document.

There is some concern that populations of some Neotropical Migrant Birds (NTMB) species, many of which nest within the Forest boundaries, have been declining recently. Since many of these NTMB have various habitat requirements, a general conclusion cannot be reached to explain the decline of all NTMB species.

In some cases a species decline may be due to a loss of wintering habitat in South America. Some of the decline may be attributable to the change in their North American habitat from factors such as urban sprawl, rural development and predation by non-native feral cats. (U.S. Fish and Wildlife Service, "Migratory Songbird Conservation", <<http://www.fws.gov/~r9mbmo/pamplet/songbird.html>>).

Nest predation is where cowbirds lay their eggs in the nests of other species, leaving the other species to raise their young, often at the expense of their own offspring. Brown-headed cowbirds have been linked to the decline in nesting success of many NTMB. Cowbirds prefer the edge between forest and openings. These edge areas can include agricultural land and corridors from powerlines. In some areas where rural development is occurring, NTMB breeding habitat may be lost when land is being permanently cleared for home sites and lawns. Maintained lawns do not provide NTMB habitat.

Partners in Flight (PIF) have completed the Bird Conservation Plan for the Prairie Peninsula area (PIF 2000) which includes the Middle River Project Area. Missouri has established a Neo-tropical Bird Working Group composed of experts from the Missouri Department of Conservation, Mark Twain National Forest, North Central Forest Experiment Station, and the University of Missouri. This Working Group is part of the National PIF effort and was created to evaluate threats to these species in Missouri and develop a list of

species of concern for Missouri. The work of this group highlights the fact that breeding habitat for neotropical migratory birds includes all successional stages and all types of habitat. *Note: See section 5 of the Biodiversity write-up in Appendix C for additional information.*

Direct and Indirect Effects on Neotropical Migrant Birds by Alternative

Note: The NTMB's use a wide variety of habitats. Therefore, it is not possible to draw a generalized conclusion, which would apply to all NTMB's.

Alternative 1 (No Action):

The amount of open areas or early successional habitat would continue to decline, while being replaced by denser forests. The effects would vary depending on the species. However, a mix of habitat types for the various NTMB's would still be provided.

Items common to all action alternatives (Alternatives 2 and 3):

Some prescribed burning may occur during the early portion of the nesting season of some Neotropical Migrant Birds. Therefore some nests and/or eggs could potentially be destroyed. However, these NTMB would likely nest again the same year. The majority of the NTMB nesting season does not occur when prescribed burns may occur. The intensity of the proposed prescribed burn is not hot enough to permanently modify their habitat. Therefore, these alternatives would maintain the amount of existing habitat. Some openings would be created in forested areas by timber harvest. The effects of this activity would vary depending on the species. However, a mix of habitat types for the various NTMB's would still be provided.

Cumulative Effects on Neotropical Migrant Birds

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful. *Note: These species have different summer and winter ranges and may migrate thousands of miles (including to other counties or continents). However their summer breeding range can vary from several acres to several hundred acres. Therefore a smaller cumulative effects boundary was chosen.*

For those Neotropical Migrant birds that require more dense and mature woodlands for breeding, clearcut timber harvest and land clearing has resulted in a temporary decline of some of their habitats. Old growth designation would help maintain habitat for some Neotropical Migrant birds. Conversely, fire suppression has resulted in an increase of their habitats. Land clearing on private lands for agriculture and/or home sites has resulted in the loss of habitat for those species that require a forested habitat.

Land use conversions on private land to intensive agricultural uses and/or home sites has also resulted in the decline of breeding habitat for some species that require grasses and shrubs. These same activities often result in increased nest predation by Brown headed cowbird, the introduction of feral cats and a greater use of pesticides, all of which may negatively impact this species population.

A wildfire could occur at any time. Smoke and/or flames may result in the temporary displacement of individuals and/or increased human activity may temporarily impact some species. A fire could destroy nests. An intense fire could destroy or create additional habitat by opening up dense forests (depending on the species).

For those Neotropical Migrant birds that require more open, lightly forested areas for breeding, timber harvest has resulted in an increase of their habitats. Conversely, fire suppression has resulted in a decline of their habitats.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

FISHERIES

Existing Condition

The U.S. Fish and Wildlife Service species list dated 7/31/02 was utilized (the 12/29/03 USFWS species list had no changes from the 7/31/02 species list). The U.S. Forest Service is legally required to provide protection to ensure survival of federally listed species. Information from the Missouri Department of Conservation's Heritage Survey Database was utilized in the completion of this section.

The Fisheries within the Middle River Project Area are typical for this section of Missouri. The primary aquatic habitat in the Middle River Project Area is along Middle River. Riffles, pool and backwater habitats are all available for aquatic species. The geographic location of the Middle River Project Area places it in the extreme southern portion of the Prairie Region and sandwiched to the south by the Big River Region and to the east by that small part of the Ozark Region north of the Missouri River. The Middle River Project Area is over 8 air miles north of the Missouri River.

Middle River is an intermittent, seasonally dry, known warm water, 7-day 2-year low flow suspected to be less than 1 cubic feet per second (cfs), known gaining. Approximately 95 percent of the entire Middle River drainage occurs on privately owned lands. Prime Creek is a known intermittent, seasonally dry, known warmwater, 7-day 2-year low flow suspected to be less than 1 cfs, known gaining. Prime Creek flows into Middle River two miles south of the Project area.

The project file contains data identifying the different fish species collected in Middle River near State Highway 54, dating back to 1941. There was one documented Topeka shiner (T&E species) sighting approximately 1.5 air miles north of the project area along Middle River in 1962. There have been no other documented Topeka shiner sightings since then. Also, it is important to note, one Blacknose shiner (RFSS listed) was collected in 1941 but none have been collected in surveys since that time.

Other fish species collected in the 1941 sample, but not collected in surveys since include: the Black bullhead, Red shiner, Orange spotted sunfish, and Suckermouth minnow. None of these species are listed in the 2003 edition of Missouri Species and Communities of Conservation Concern Checklist. The striking commonality among these species is that each is common in the Prairie aquatic region as described by Pflieger (The Fishes of Missouri, 1997). Pflieger describes these species as less likely to penetrate into high-gradient streams of the central Ozark Region. It would appear these species were on the fringe of their principle range and no longer occur at the Highway 54 sample site 0869, an intermittent part of the Middle River.

There are two Middle River fish sample sites downstream of site 0869. These are numbered 1000 and 0870. Sample site 1000 was sampled in 1995 and is located about halfway between Highway 54 and the Missouri

River. The Black bullhead, Red shiner, Orange spotted sunfish, Suckermouth minnow, Blacknose shiner and Topeka shiner were not found at Sample site 1000 in CY 1995. Sample site 0870 was sampled in 1992 and is located at the Highway 94 bridge crossing, three river miles above the Missouri River in what Pflieger describes at the Big-River Faunal Region. Except for the Orange spotted sunfish, none of the above listed fish species were collected at site 0870 in 1992. The Orange spotted sunfish occurs less abundantly in extreme headwater situations but does occur in backwaters and overflow pools of larger streams. It is tolerant of high turbidity and siltation. This could be the reason this species is present in Middle River at the Highway 94 crossing. None of the alternatives will have a cumulative impact (negatively or positively) on the above fish species.

There are no waters within the project area listed on the 1998 State of Missouri 303(d) list of polluted waters. The reclaimed clay pit in Middle River Project Area contains Channel catfish, Largemouth bass and Bluegill. Ten small ponds within the project area were also described in the watershed section of this document. Seven of these ponds have been stocked for game fish, including bluegill, channel catfish and largemouth bass.

Direct and Indirect Effects Common to all Alternatives:

Goals for the MTNF Fisheries Program can be found in the LRMP, IV 2-3. The primary fisheries goals for the MTNF are to protect aquatic ecosystems, restore degraded aquatic ecosystems, and enhance aquatic resource user opportunities. Forest-wide Standards and Guidelines for the Fisheries Program can be found in the LRMP, IV-49.

All pond and lake dams would be maintained by keeping the dams in grass/shrub vegetation and repairing any parts of the dams and spillways.

The foot and horse trail in Compartment 9, stand 2, where it crosses Middle River, would be maintained to minimize sediment into the stream. This trail crossing provides access to the Middle River for wading as well as access to the northern portion of the area. There is an associated parking area providing access to this crossing, which would be maintained to minimize sheet erosion.

On National Forest lands, special habitats (glades, springs, seeps, fens, wetlands, riparian corridors, bottomland hardwood forest, caves, and sinkholes) would be protected and managed as needed to maintain the unique qualities of these areas.

Alternative 1:

With no physical alteration of the Middle River channel, no conversion of forested riparian to other land uses, and no additional sediment reaching the Middle River, there would be no effect on the suitability of the Middle River for aquatic wildlife. The same can be said for the intermittent drainages, which drain into Prime Creek. However, no watershed improvements such as erosion control structures, fencing or tree planting would be made in this alternative, therefore no improvements would be made to the overall water quality of drainages to Middle River and Prime Creek.

Alternative 2:

The proposed skid trails could degrade aquatic ecosystems by increasing levels of fine sediment deposited in streams and by altering natural streamflow patterns. Utilizing Best Management Practices (BMPs) and mitigation measures described in this document, this potential erosion will be reduced and be short-term.

Following a timber harvest, suspended solid concentrations increase during peak stormflow events; however, it takes relatively high-suspended solids in excess of 20,000 mg per liter to cause behavioral reactions in most fish species. Use of BMPs can reduce levels of suspended solids as vegetation re-establishes after silvicultural activities; therefore, these activities will not adversely affect beneficial water uses. With no sediment reaching the Middle River, no physical alteration of the Middle River channel, and no conversion of forested riparian to other land uses, there would be no effect to the suitability of the Middle River for aquatic wildlife.

The spot application of herbicides to fescue sod would have the effect of helping the planted hardwoods becoming better established. *Note: It would not have a negative effect on the areas watershed or fisheries resource. This is because there will be no broadcast spreading of herbicide and the hand treatment of individual plants will reduce the possibility of runoff into any nearby water systems as well as leaching from contaminated soil and/or accidental spills into the water systems.*

The hardwood plantings adjacent to Middle River would improve the overall riparian habitat and related fisheries. Other watershed improvements such as fencing woodlands and improving drainage crossings would improve the water quality of the side drainages, therefore improve aquatic habitat in Middle River.

Reconstruction of one pond with the associated livestock fencing and then stocking would provide recreational fisheries opportunities.

Alternative 3:

Effects would be the same as Alternative 2.

Cumulative Effects on Fisheries

The spatial boundary considered for cumulative effects is the Middle River Watershed. The time period considered for cumulative effect is 10 years. This is the extent that the effects are measurable and meaningful.

National Forest lands total a small percentage (estimated less than 5 %) of the Middle River Watershed. Therefore, during the next decade, private landowners will determine land uses on approximately 95% of the Middle River Watershed. Current land uses on private ownerships include homes, pastures, cropland, forest, and small businesses. Private lands are a mixture of open pastures, cropland, developed areas, and some forest. Past trends on private land are toward an increase in fescue pastures and developed areas. Private woodlands have been harvested. If these trends continue, it is likely that there will be less forest on private ownerships at the end of this decade, and more openland or developed land. These uses are unlikely to change in the next decade.

Alternative 1

Short-term fish and aquatic population fluctuations can be expected for some aquatic species. Long-term population and even species trends may change during the next decade, since private landowners would determine land uses on approximately 95% of the Middle River Watershed. Stream channels morphology changes, without the protection of a riparian corridor, tends to affect the numbers and types of aquatic species present. Without the proposed watershed improvements, some sedimentation in side drainages would continue, therefore reducing the long-term aquatic habitat.

Alternative 2

National forest lands within the Middle River Watershed will be managed to maintain a variety of forest age classes, sizes, structures, and native species.

Watershed improvements proposed in Alternative 2, combined with on-going management and past activities would improve the overall fisheries habitat in the Middle River within Forest Service ownership. Riparian tree planting, combined with the old growth designation of timbered stands along Middle River and drainages, would improve the overall watershed and therefore improve fisheries habitat. The spot application of herbicides to fescue sod would have the effect of helping the planted hardwoods becoming better established. *Note: It would not have a negative effect on the areas watershed or fisheries resource. This is because there will be no broadcast spreading of herbicide and the hand treatment of individual plants will reduce the possibility of runoff into any nearby water systems as well as leaching from contaminated soil and/or accidental spills into the water systems.*

The Middle River Project would not affect the long-term viability of the existing fisheries or aquatic life because effects of the proposed timber sales would be mitigated. Habitat for aquatic species on the MTNF lands will be available in approximately the same amount and distribution as currently exists. However, long-term population trends and even species composition may change as during the next decade, private landowners will determine land uses on approximately 95% of the Middle River Watershed. Stream channels morphology changes, without the protection of a riparian corridor, tends to affect the numbers and types of aquatic species present.

Alternative 3

Effects would be the same as Alternative 2.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

• Threatened, Endangered and Proposed Fish Species:

The U.S. Fish and Wildlife Service species list dated 7/31/02 was utilized (the 12/29/03 USFWS species list had no changes from the 7/31/02 species list). The U.S. Forest Service is legally required to provide protection to ensure survival of federally listed species. Information from the Missouri Department of Conservation's Heritage Survey Database was utilized in the completion of this section. *Note: additional information is contained in the Biological Evaluation for Threatened, Endangered and Proposed species, which is located in Appendix G.*

Existing Condition

There are no Threatened, Endangered and Proposed fish species which are documented to occur in the Middle River Project area or may occur in the Middle River Breaks portion of the Oak-Hickory Hills LTA.

Threatened, Endangered and proposed wildlife species that may occur in the Middle River Project area, due to previous sightings:

Topeka Shiner (*Notropis topeka*): There was one documented Topeka shiner sighting approximately 1½ air miles north of the project area along Middle River in 1962. There have been no other documented Topeka Shiner sightings since then. The most likely place for a Topeka shiner to occur on the Cedar Creek Unit is in the Cedar Creek drainage. *Note: The Cedar Creek drainage does not occur in the Middle River Project Area.*

The Topeka Shiner prefers undisturbed Prairie streams. It can tolerate a wide range of temperature fluctuations (near freezing to 90 degree Fahrenheit). It breeds from May to mid-July. However, it has been found in canals and ditches.

There are several impacts that may be detrimental to the Topeka shiner and the headwater streams where it is found. This includes impoundments on the headwater streams. These impoundments may result in the introduction of predatory species such as the largemouth bass and they alter the hydrology of headwater pools that can fill in with gravel and leaves more rapidly. Other concerns include: channelization, sediment and agricultural activities such as grazing and fertilizing fields that can result in additional eutrophication in the areas waters (Topeka shiner section of the 1998 MTNF BA).

The surrounding private land consists mainly of agricultural land and scattered houses. The watershed has been impacted by the activities on private lands.

Direct and Indirect Effects of Threatened, Endangered and Proposed Fish Species by Alternative:

Since the Topeka shiner no longer occurs in the Middle River drainage (and the Middle River drainage does not drain into any Topeka shiner habitat), there would be no direct or indirect effect on the Topeka shiner or its habitat.

Cumulative Effects of Threatened, Endangered and Proposed Fish Species:

A cumulative effects spatial boundary of the Middle River drainage was selected because any activities could potentially affect Middle River itself. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Since the Topeka shiner no longer occurs in the Middle River drainage (and the Middle River drainage does not drain into any Topeka shiner habitat), there would be no cumulative effect on the Topeka shiner or its habitat.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

- **Regional Forester Sensitive Fish Species**

The National Forest Management Act (NFMA) regulations of 36CFR 219.19 specify that fish and wildlife habitat will be managed to maintain viable populations of existing native and desired non-native species. This requirement is further developed in Chapter 2670 of the Forest Service Manual, which establishes a “Sensitive” category to include animal, plant, and fish species in addition to indicator species whose viability is a concern to the Forest Service. The objective is to ensure that these species do not become threatened and endangered because of Forest Service actions. The February 29, 2000 (Including October 23, 2003 list update), Forest Service R-9 Regional Forester Sensitive Species (RFSS) list is utilized. *Note: Additional information is contained in the Biological Evaluation for RFSS species in Appendix G.*

Existing Condition

Sensitive fish species that are documented to occur in the Middle River Project area:

There are no documented sensitive fish species in the Middle River Project area.

Sensitive fish species that may have suitable habitat in the Middle River Breaks portion of the Oak-Hickory Hills LTA:

There are no RFSS fish species that are found in the Middle River Breaks portion of the Oak-Hickory Hills LTA.

Sensitive fish species which are not likely to occur in the Middle River Breaks portion of the Oak-Hickory Hills LTA and the Middle River Project area due to a lack of suitable habitat:

This includes the Blue sucker, Ozark shiner, Sabine shiner, Longnose darter, Stargazing darter, Eastern slim minnow, Blacknose shiner, Blueshape darter and the Crystal darter. *Note: Because these Sensitive fish species and their habitat does not occur in the Middle River Project area including the Middle River Breaks portion of the Oak-Hickory Hills LTA they will not be discussed any further in this document.*

- **State of Missouri Endangered Fish Species**

The March 1, 2003 State Endangered species list (section 3CSR10-4.111 of the Wildlife Code of Missouri) was utilized in the preparation of this section. The Forest Service addresses all state of Missouri Endangered species.

Existing Condition

There are no documented State of Missouri Endangered fish species in the Middle River Project Area.

State of Missouri Endangered Fish Species that have suitable habitat in Callaway County and are documented to occur in Callaway County:

Topeka Shiner (*Notropis topeka*): (See the Threatened and Endangered fish section for additional information).

Flathead Chub (*Platygobio graclis*): This chub is found in 3rd to 9th order streams. It is found in clear to turbid waters in sand and bedrock bottoms and in various currents. In July and August it spawns in smaller creeks. The flathead chubs are often found in schools with other big river minnows.

Crystal Darter (See the Sensitive fish species section).

Lake Sturgeon (*Acipenser fulvescens*): The lake sturgeon is found on the bottoms of rivers, streams and lakes. However it spawns in flowing waters with a gravel or rock substrate. It is usually found in larger bodies of waters such as the Missouri River.

Pallid Sturgeon (*Scaphirhynchus albus*): This sturgeon is often found near the shovelnose sturgeon. The females mature between 15 and 20 years of age. They are usually found in the main channels of rivers such as the Missouri. It is usually found in swift currents that have a sand or gravel bottom. This sturgeon is tolerant of silt and turbidity.

Direct and Indirect Effects of State of Missouri Endangered Fish Species by Alternative:

Lake Sturgeon, Pallid Sturgeon and Flathead chub:

No direct or indirect effects are anticipated for these species since these species do not occur in the Middle River Project Area or the Middle River watershed (approximately 95% of this watershed occurs on private land).

Cumulative Effects of State of Missouri Endangered Fish Species:

A cumulative effects spatial boundary of the Middle River drainage was selected because any activities could potentially affect Middle River itself. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Lake and Pallid Sturgeon:

No cumulative effects are anticipated for these species since these species do not occur in the Middle River Project Area or the Middle River watershed (approximately 95% of this watershed occurs on private land). These species are located in the Missouri River, which is located approximately 8 miles downstream from the Middle River Project Area.

Flathead Chub:

No cumulative effects are anticipated for these species since these species do not occur in the Middle River Project Area or the Middle River watershed (approximately 95% of this watershed occurs on private land).

State of Missouri Endangered Fish Species that may have suitable habitat in Callaway County and are documented likely to occur in Callaway County:

There are no State of Missouri Endangered fish species that apply to this criteria.

State of Missouri Endangered Fish Species that are not documented to occur in Callaway County due to a lack of suitable habitat:

This includes the Ozark cavefish, Spring cavefish, Goldstripe darter, Harlequin darter, Longnose darter, Niangua darter, Redfin darter, Mountain madtom, Neosoo madtom, Cypress minnow, Sabine shiner, Taillight shiner, Central mudminnow and the Swamp darter. *Note: Because these State Endangered species and their habitat does not occur in the Middle River Project Area they will not be discussed any further in this document.*

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

SPECIALIZED HABITATS**Existing Conditions**

Specialized habitats and species associated with them are described in the LRMP Chapter IV page 51-58 and Forest Service Handbook 2609.21 (for the Mark Twain National Forest). These specialized habitats provide for a wide variety of species.

Caves: There is no karst topography and there are no known caves in the Middle River Project Area.

Springs, Seeps and Fens: The springs on Forest Service land are excluded from grazing allotments. However, water from some of the springs is used occasionally and intermittently to water livestock. Various types of salamanders may utilize some of these areas. Numerous wildlife species utilize these areas as water sources. No fens are known to occur in the Middle River Project Area.

Riparian Areas and Bottomland Forests: Middle River flows through a portion of the Middle River Project Area. There is a broad variety of structural and vegetative conditions which results in the large species diversity found in these areas. These areas can provide potential habitat to a broad array of species such as Bald eagles, herons, waterfowl, Neotropical Migrant Birds, turtles, snakes and to invertebrates such as salamanders, frogs and toads. Prior to acquisition by the Forest Service some of the riparian areas and bottomland forests in the Middle River Project area had been converted to fields for grazing cattle, growing hay and row crops. However, approximately 95 percent of the bottomlands along Middle River are in private ownership.

Shortleaf Pine Forest: There is less than 1 acre of Shortleaf pine plantation in the Middle River Project Area. This is a long and narrow piece. The Cedar Creek Unit lies outside the natural pine range.

Fishless Ponds and Temporary Pools: There are scattered ponds throughout the Middle River Project Area. The size and longevity (of present water) can vary greatly and these temporary pools can range from depressions in the bottomlands that fill after flooding or depressions in the upland that fill after a rain. These areas are a water source for numerous wildlife species. In addition they provide habitat for amphibian species such as frogs, toads and salamanders.

Glades: There are no large glades located within the Middle River Project Area. Glades are natural openings in the Ozarks that occur on southern, southeastern and southwestern slopes in areas where the soil is shallow, undeveloped or even absent. These harsh conditions limit the amount and type of vegetation present to species such as warm season grasses or coneflowers.

Open and Semi-Open Habitats: These open and semi-open lands are composed of several different habitat types: cool season grass; warm season grass; shrub grass; savanna-grass, and savanna-shrub. These habitats are utilized by numerous species for all or part of their lifecycle. Species utilizing these areas include, whitetail deer, eastern wild turkey and the eastern bluebird. There are two grazing allotments in the Middle River Project area; this livestock grazing helps to maintain these areas. See Chapter 4 for further discussion.

Sinkholes: There is no known karst topography or known sinkholes in the Middle River Project area. Sinkholes often occur as a result of the collapsing underlying caves.

Direct and Indirect Effects of Specialized Habitats by Alternative

Caves

Alternative 1 (No Action):

Since there are no known caves in the Middle River project area, there would be no impact to the cave resource. In addition no activity (with the possible exception of wildfire control activities) would occur in steep areas or along the bluffs where a cave entrance would most likely occur.

Alternative 2 and 3:

Since there are no known caves in the Middle River Project Area, there would be no impact to the cave resource. In addition no timber harvest would occur in steep areas or along the bluffs where a cave entrance would most likely occur.

Prescribed fire would occur over a portion of the area. No mechanical fireline construction would occur in steep areas or along the bluffs overlooking Middle River where a cave entrance would most likely occur.

Springs, Seeps and Fens

Alternative 1 (No Action):

No watershed improvement projects would occur. Therefore there would be no long-term reduction in sediment production.

Items common to all action Alternatives (Alternative 2 and 3):

There is the potential that a prescribed fire could burn near a spring or seep. Watershed improvement projects would occur. These activities would result in a long-term reduction in sediment production.

Riparian areas and Bottomland Forests

Alternative 1 (No Action):

No planting of bottomland hardwood species would occur in riparian areas. No other watershed improvement projects would occur in riparian areas.

Items common to all action alternatives: (Alternative 2 and 3):

These alternatives include numerous watershed improvement projects, such as planting hardwoods, limiting livestock access to sensitive areas by fencing, reconstructing an existing road with drainage crossing, applying spot gravel, closing a non-system road and some wells.

Shortleaf Pine Forest

Alternative 1:

The existing pine plantation would remain for the next several decades.

Alternative 2 and 3:

These alternatives may remove a few pine trees, thus slowing conversion to a more natural oak/pine stand.

Fishless Ponds and Temporary Pools

Alternative 1 (No action):

There would be no activities in or near any fishless ponds and temporary pools. Therefore, there would be no direct or indirect effects.

Items common to all action Alternatives (Alternative 2 and 3):

Some prescribed burning or other activity may occur adjacent to some fishless ponds and temporary pools. However, there are no anticipated long-term impacts to these areas. Some of the watershed improvement projects may actually fill in some of these areas.

Glades

Items common to all Alternatives:

Since there are no glades or glade habitat in the Middle River Project Area, there would be no direct, indirect effects on glade habitat.

Open and Semi-Open Habitats

Alternative 1 (No action):

Cattle grazing, which would help to maintain these open and semi-open habitats, would continue in these areas. As a result of fire suppression, the existing amount of semi-open habitat would continue to decline due to plant succession

Items common to all action alternatives (Alternative 2 and 3):

Grazing and/or mowing and/or prescribed burning would help to maintain some of the project area's open and semi-open habitat. In addition, some timber harvest would occur in the area. This would help to maintain open and semi-open areas as well. The use of herbicides would help maintain the suitability of open areas for many species by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Alternative 2:

Grazing and/or mowing and/or prescribed burning would help to maintain some of the project area's open/semi-open habitat, but at a reduced level from Alternative 1. A total of 75 open acres would not be grazed or burned in the future. About 30 acres would be allowed to naturally reforest; the remaining 45 acres in the above openings would be planted with native hardwoods.

Alternative 3:

Grazing and/or mowing and/or prescribed burning which would help to maintain some of the areas openings would continue, however at a reduced level than Alternative 2. A total of 30 open acres would not be burned in the future, allowing these areas to naturally reforest themselves. Approximately 8 acres in the above openings would be planted with native hardwoods.

Sinkholes**Items common to all alternatives:**

Since there are no known sinkholes in the Middle River Project Area, there would be no direct or indirect effect on any sinkholes.

Cumulative Effects of Specialized Habitats

A cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. A cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River Project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Caves

No known caves occur in the project area. Human disturbance on any caves on private lands would continue. Natural events such as the collapse of cave rocks and/or flooding would continue on any existing caves on private lands.

Springs, Seeps and Fens, Riparian areas and Bottomland Forests

Some bottomland hardwood habitat would continue to be lost on private lands due to land clearing for agriculture and/or home sites. The draining and/or filling in of wet areas would continue on private lands.

Shortleaf Pine Forest

Shortleaf pine plantations would continue to be maintained. In the foreseeable future some pine plantations with an oak component would slowly convert to an oak-pine forest.

Fishless Ponds and Temporary Pools

The existing fishless ponds and temporary pools would continue to fill in slowly.

Open and Semi-Open Habitats

Land use conversions from previously open lands or semi-forested areas to agriculture and/or home sites would continue on private lands. Fire suppression would continue, thereby resulting in a decline of open glade habitats. However, a large and intense wildfire could occur, thereby creating additional open, semi-open habitat. Prescribed fire would help to maintain some of these habitats. Natural succession would result in woody encroachment into some of these areas, and therefore there could be a decline in open/semi-open habitat. The use of herbicides would help maintain the suitability of open areas for many species by preventing noxious weeds from spreading and becoming better established. Noxious weeds out compete and displace native species.

Glades & Sinkholes

Since there are no known glades (or glade habitat) or sinkholes in the Middle River Project area, there would be no cumulative effects on these habitat types.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

SOCIAL AND ECONOMIC ENVIRONMENT

RECREATION

Existing Conditions

Although the Cedar Creek Unit and the Middle River Project Area fall outside the Ozark-Ouachita Highlands Assessment (OOHA), some of the statistics related to recreational pursuits apply. The population centers of St. Louis and Kansas City are within a two-hour drive of the area. The cities of Jefferson City and Columbia with a combined population of over 120,000 are within 30 minutes of the Cedar Creek Unit. The Cedar Creek Unit is the only National Forest land north of the Missouri River and in north-central Missouri. Other providers of public recreation include the Missouri Department of Conservation and the Missouri Department of Natural Resources. Among the public land managing agencies, the Forest Service has the largest land base in Callaway County to provide dispersed recreation opportunities (e.g., primitive camping, hunting and trails).

Nationally, recreation use is projected to increase in nearly all activity categories. The largest projected increases are for activities involving visiting historic sites, sightseeing, visiting beaches or other water sites, and biking. Activities showing slight decreases in number of participants by the year 2010 are hunting, primitive camping, and off-road driving. Rock climbing, backpacking, and floating/rafting are also projected to decline slightly. These projected declines may be a reflection of a projected increase in the average age of the population (OOHA, 1999, Cordell and others, 1997a).

According to expenditure data from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, there are major economic impacts from recreation in Missouri. Resident anglers and hunters alone supported over 28,800 jobs in Missouri. The earnings generated from their expenditures exceeded 1 billion dollars, and state sales tax generated was over 47 million dollars. With a continued rise in tourism, each year recreation will play a more important role in the Missouri economy.

The Middle River Project Area is classified as “Rural” in the Recreation Opportunity Spectrum (ROS) for the MP 3.4. The ROS is a framework system developed by the Forest Service to more fully understand relationships and interactions of the many facets of outdoor recreation. One product of ROS is the opportunity setting: a combination of social, physical, geological, and managerial conditions that give value to a place. Six classes are recognized. (LRMP, Appendix G). Within the Rural setting, there will be evidence of management and human activities. Resource modification and utilization are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high (LRMP, Appendix, G-2).

No developed recreation areas fall within the Middle River Project Area. Dispersed recreation opportunities are similar to those found elsewhere on the Cedar Creek Unit. The primary recreational use of the area is hunting, horseback riding, fishing, gathering forest products, and wildlife viewing. Dispersed camping occurs during spring and fall, coinciding with the fall and spring hunting season for deer and turkey. Middle River forms the northeastern boundary of the area and provides fishing and swimming opportunities. A foot trail provides access to the river from a parking area at this northeastern boundary. Five parking areas provide access to the area. Bluffs along Middle River provide several scenic views of the area and several rock shelters provide interesting geology. Stocked ponds and the larger pond from an old clay pit provide additional fishing opportunities.

The Cedar Creek Unit has a 36-mile developed trail system approximately 10 miles northwest of the Project Area. This trail, along with two campgrounds and a day-use area, provide developed recreation on the Cedar Creek Unit. The trail is open to hiking, mountain biking and horseback riding. Other public lands in the surrounding area include several MDC Conservation Areas and DNR state parks. In Callaway County these include the Reform Conservation Area about 10 miles east of the Project Area, the Earthquake Hollow Conservation Area about 5 miles southwest of the Project Area, Whetstone Creek Conservation Area, about 25 miles to the northeast of the Project Area and the Little Dixie Conservation Area, about 20 miles northwest of the area. In Cole County, the Smokey Waters Conservation Area is approximately 12 miles to the south of the Project Area. Other MDC areas provide river access to the Missouri River to the south of the Project Area. The Katy Trail State Park, managed by the DNR, is located approximately 10 miles south of the Project Area. It is a converted railroad line that is open for hikers and bicycles. Finger Lakes State Park, approximately 35 miles to the northwest of the Project Area, provides ATV trails and camping. In general, the state parks are not open to hunting.

A private campground approximately 15 miles to the north of the Project Area provides opportunities for developed camping. Another private campground, located approximately 8 miles to the northeast of the Project Area provides trails for motorized (ATV) use.

Direct and Indirect Effects on Recreation by Alternative

Alternative 1 (no action): Implementation of this alternative would have minimal effects on recreation opportunities available in this project area. The Middle River Project Area would continue to provide opportunities for dispersed recreation and both consumptive and non-consumptive wildlife uses. In the absence of vegetation management, the population of deer and turkey would be lower with loss of openings in the forest. Habitat diversity would also be reduced. Recreational access would be reduced with no improvement to parking areas or access.

Alternative 2: This alternative would provide improvements to access the area. Vegetation manipulation through timber harvest and thinning as well as prescribed burning would improve hunting opportunities and wildlife viewing opportunities. Firewood opportunities, a form of recreation to some people, would be made available following timber harvest. Interpretive signing on the cultural history would improve the recreational user's experience. The addition of a walk-through gate would improve access for various recreational users. The addition of gravel at the parking areas would also improve access to the area.

The impacts of harvest activities, like the noise of chainsaws or increased truck traffic, would affect some recreation activities being pursued on weekdays, though most recreation activities take place on weekends.

Planting areas to hardwoods will improve riparian corridors and the wildlife habitat within, therefore improving future recreational opportunities associated with wildlife viewing. The prescribed burning of stands and open lands would cause a temporary “blackened” appearance until vegetation sprouts or reseeds creating a green vegetative appearance. Some forest visitors may not like the appearance. However, as burning effects begin to show with grass growth and wildflowers, these areas should become more attractive for viewing. Similar vegetative management activities were conducted in the southern portion of the Middle River Project Area (Compartment 10) about ten years ago and no significant effects to recreation occurred.

Closure of some non-system roads would reduce some non-authorized motorized access into the area, improving the experience for other, non-motorized users.

Alternative 3: The effects to recreation of this alternative would be similar to Alternative 2. Fewer areas would be planted to hardwoods in this alternative, therefore, modifying this long-term habitat change and future type of recreational benefit.

Cumulative Effects on Recreation

A cumulative effects spatial boundary in regards to recreation is Callaway County and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful in regards to the recreational resources.

There would be very little difference in the cumulative effects of implementing Alternatives 2 and 3. Dispersed recreation opportunity would be provided in all three alternatives. The cumulative effect of any of the alternatives would have minimal effects on the overall recreation setting and the potential recreation use pattern into the future. Some river-related recreation may increase with improved parking and the interpretive signing of the area. Some recreation use takes place on private land (such as hunting, viewing wildlife, hiking, off-road use, fishing and horseback riding) and that is unlikely to change because of the projects proposed. Individual landowners may change what types and amounts of use take place on their land for reasons of their own.

Increasing populations in Callaway County and surrounding Cole and Boone Counties, along with dividing of private lands into smaller home tracts, will increase demand on public lands for dispersed recreation in the future. Demands for motorized recreation on public lands may also increase in the future. However, one private campground provides this opportunity in Callaway County. Other public lands available for dispersed recreation (mentioned in the existing conditions’ section above) would continue to provide these opportunities into the foreseeable future.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

VISUAL QUALITY

Overview

The Mark Twain Land and Resource Management Plan (LRMP) establishes Visual Quality Objectives (VQO) for each management prescription. The VQO for a specific area is determined by relating the

variety class and distance zone/sensitivity level mapped for each district to the visual quality matrix found in the Standards and Guidelines (S&G's-2300) for each management prescription.

The Middle River Project Area is in the Variety Class B-Common (LRMP, IV-115) within the MP 3.49. State Highway BB is a Sensitivity Level Two travelway and has a VQO of Partial Retention (PR) to Modification (M). All the other roads in the project area are Sensitivity Level Three with a VQO of Modification. (Visual Management System Map for the area is available at the district office). A table using travel speed, VQO, and Sensitivity Level determines the slash disposal height. (LRMP IV-34). The slash disposal height requirements mitigate the negative visual impact of harvest activity and shorten the length of time the slash would be visible.

Existing Conditions

The Middle River Project Area is in the MP 3.4 and is characterized by moderately rolling, rocky topography with broad ridges, valleys, springs, and creeks. The adjacent private land is both forested and open land. There has been management activity in the area over the past 20-30 years. Evidence of these past activities can be seen in the varying size of the trees in different stands and types of vegetation. The vegetation and wildlife diversity is typical for this area. Large overstory deciduous trees and cedar, as well as young trees and openings are interspersed throughout the project area. The road surfaces on private lands within the project area are blacktop and gravel with slow to medium speeds.

Direct and Indirect Effects on Visual Quality by Alternative

The broad/generalized effects on the visual resource associated with the management activities proposed in this project are contained in the Final Environmental Impact Statement (FEIS) portion of the LRMP. Reference the following headings: Management Problem 4 - Wildlife IV-22; Management Problem 6 - Road Network IV-30; and Management Problem 7 - Timber Resource Management IV-35 and 36. More detailed site-specific effects are contained in the following alternative discussions.

Application of the Mark Twain's LRMP Forest-Wide Standards and Guidelines, Chapter IV-31-36 relative to the visual resource, would help mitigate adverse impacts and achieve visual resource objectives. Standard mitigation measures are described in Appendix F of the LRMP. More detailed site-specific mitigation measures are contained earlier in this document.

All proposed actions have been reviewed by the forest landscape architect through field visits and/or map review and would meet the established VQO unless specifically noted otherwise in the following discussion. No timber harvesting activities are being proposed within the near foreground seen area along Highway BB.

The general effects of the proposed actions on the visual quality of the project areas are addressed in the following discussion.

Alternative 1: No Action

No changes from the existing visual condition would be expected to occur. Barring natural disturbance, it is anticipated that the existing visual condition of the project area would be relatively maintained. The project area as a whole would appear as a natural mature or old growth forest with open and semi-open areas. There would be less visual variety over time and no reduction of non-native invasive noxious weeds or hardwood plantings.

There would continue to be open woods and fields due to natural soil fertility, natural disturbance (windstorm, insect & disease, etc.) or wildfire.

Alternative 2 (Proposed Action):

Harvests would cause a reduction in number of trees per acre, create additional slash on the ground, and require temporary roads or landings that would be visible from the Forest Service road. The effects of harvest on visual values adjacent to these roads would be minor and stay within the VQO for that area. Thinning and removing the overstory would allow the remaining trees to grow larger. Opening up the understory would give the forest user an opportunity to see into the woods from the roadway at a greater distance and providing an opportunity to see wildlife and varying plant material. The percent of open and semi-open areas would be reduced and would be planted or allowed to reforest. The areas for prescribed burning would only show the black until spring green up, limiting the time that it would be visible to weeks. The five parking area improvements would improve the visuals of user created sites and their usability.

This alternative would have the most activity visible from the travelways and existing non-system roads.

Alternative 3:

The visual effects of this alternative would be similar to Alternative 2. The immediate effects of the proposed burning activity would be visible only until the plants grow in the spring and the burning would reduce woody fuels and encourage grasses and forbs in the open areas, providing for visual variety and an opportunity to view wildlife.

Changing of stand boundaries along drainages in Compartment 9 as well as the change in old growth designation would improve the overall viewshed in the immediate area and address comments raised from the public.

Cumulative Effects on Visual Quality

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful.

The scope of cumulative effects on visual resources is limited to the area from which the proposed and past treatment areas can be seen. Evidence of previous management practices is visible from some of the roads. Private land management, including cattle grazing, timber cutting, and conversion of woods to pasture can also be seen near the project area. Because these past activities are visually evident, the proposed actions would not change the overall character of the landscape.

All alternatives would meet the assigned visual quality objectives of partial retention to maximum modification for the project area due to seen area and mitigation. The use of site-specific mitigation measures that follow Forest Plan standard and guidelines would aid in meeting those objectives. The cumulative effects of past cutting, the proposed treatments, and activities in the reasonably foreseeable future would result in a forest area that is natural appearing and meets the VQO desired future condition for the project area as identified in the Forest Plan.

Private land uses are likely to remain much the same as in the past 10 years, with more farms being divided into smaller home tracts. Much of the private land is in pastureland or forest. Therefore, more dwellings

and outbuildings on the private land would be visually evident in the future with varying farm and timber practices occurring.

In all of the alternatives, several things would remain the same. The highways and roads would continue to exist, but may be altered, improved or relocated. Natural disturbances, such as windstorm, ice storms, frosts, insects/disease would continue to affect the project area. Fire protection would continue because it is a policy of the Forest Service to protect resources from wildfire, and because the proximity of private lands and dwellings makes it imperative. The local economy would continue to rely in some part on wood products - which would be removed from private lands as well as other public lands. Hiking, trail riding, hunting, fishing, trapping and other recreational pursuits would continue.

Alternative 1 would mean that mostly natural disturbances would occur. All communities present would continue to exist, including the open, semi-open habitat, although the amount of each community type might fluctuate over time. Fire protection would keep wildfires to a minimum, so it is unlikely that fire would be a factor. The oak communities would continue to mature and decline, with many small openings created by natural mortality of individual trees and some larger openings created by windstorm, ice damage, insect, disease, or other disturbance. A large percent of the forested area would eventually be in mature and old growth successional stages with only a small amount of early to mid successional stages. Roads would still exist and be used. There would be neither reduction of non-native, invasive noxious weeds nor any use of herbicides as spot treatments. Nor would there be any management activity to reduce competition in hardwood plantings.

Alternative 2 would allow for regeneration of the maturing and declining stands and identify the areas of old growth to maintain. Open woods (an overstory of medium to large size trees with few mid-story trees and abundant ground cover of grasses and forbs) and the open, semi-open habitat would be recreated and maintained through a combination of activities. The areas along travelways and private land would contain open and forested sections on both sides of the roads, providing for visual variety.

Alternative 3 is visually similar to alternative 3, with additional visual considerations in the stand changes in Compartment 9 and changes in old growth proposed improving the overall viewshed in those immediate areas.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

HERITAGE RESOURCES

Existing Conditions

Cultural resource inventory surveys in the Middle River project area have focused on those stands and areas in which activities are proposed that have the potential to affect archaeological sites, as outlined below (Definition of Effects and the Areas of Potential Effects). The entire 1300 acres in the Middle River Project Area have been surveyed for cultural resources. A listing of the reports documenting the various surveys in the Middle River area, as well as a map showing the locations of these cultural resource surveys, may be found in the project file.

Pursuant to 36 CFR 800.4 and 5, consultation with the Missouri State Historic Preservation Officer (SHPO) has been completed with respect to the expected effects on the cultural resources of the various actions proposed in the alternatives for the Middle River project area. The Missouri SHPO concurs that cultural resource surveys for the project area meet current standards and also concurs with the Forest's determination both of National Register significance and eligibility for the various archaeological sites and of the expected project effects on significant sites (copies of correspondence relating to this consultation are on file with the Mark Twain National Forest).

Twenty-seven (27) archaeological sites have been identified to date in the Middle River Project Area. Of these sites, sixteen (16) contain evidence for prehistoric occupation, eight (8) contain evidence for historic period occupation, and three (3) archaeological sites have evidence of both. All of these sites are typical of this area. Information on the cultural sequence and on both the historic and prehistoric backgrounds for the Middle River Project Area can be found in Hill (2003). This report also contains summary information on the archaeological sites, as well as maps showing the locations of the cultural resources. The Site Inventory Forms (on file with the Mark Twain National Forest) provide more detailed descriptions of each of the archaeological sites.

Most of the prehistoric sites in the project area appear to be small, essentially surface, or very shallow, scatter of lithic artifacts. This type of site represents an ephemeral, short-term camp or work site. The shelter sites and larger habitation sites, in contrast, are likely to contain material spanning a large time period, and were likely repeatedly used throughout prehistory. It is likely that these sites date from the very early prehistoric Early Archaic stages to the much later Woodland stage. A specific concern relating to prehistoric sites in the Middle River Project Area is the extensive looting which has occurred at these sites. Most, if not all, of the caves, shelters, and burial cairns present in the area have been vandalized.

As with the prehistoric archaeological record, the historic record of the Cedar Creek Unit is also quite diverse. Historic sites found in the area range from small homesteads to industrial sites. Small family cemeteries are also present. The historic period sites and features include farmsteads and rural domestic dwellings; historic fields; features such as stock tanks and stone piles associated with historic use of this area for farming, homesteading, and livestock grazing. Data on the ages of the occupations at the various historic sites appear to date from as early as the latter part of the nineteenth century or very early twentieth century.

The site density in the analysis area is one site every 50 acres, over twice than the Forest average of one site every 126 acres. This also hold true when broken down between prehistoric and historic sites. Prehistoric site density in the analysis area is one site every 65 acres, compared to the Forest average of one site every 220 acre; while the average for historic sites is one every 162.5 acres in the project area and one every 294 acres for the Forest.

Investigation at some of the archaeological sites to date is presently insufficient to fully evaluate them again for the National Register of Historic Places (NRHP) significance criteria as found in 36 CFR 60. These archaeological sites, therefore, are being managed as unevaluated properties that appear to meet one or both of principally two NRHP significance criteria as found in 36 CFR 60.6:

1. Criterion A: That are associated with events that have made a significant contribution to the broad pattern of our history;
2. Criterion D: That have yielded, or the potential to yield, information that is important to prehistory or history.

These sites are afforded protection from project activities that may harm the sites in the same manner that eligible sites are protected.

Definition of Effects and Area of Potential Effect (APE)

An Effect to a cultural resource is defined as "...alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." [36 CFR 800.16(i)]. An Adverse Effect is found "when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." [36 CFR 800.5(a)(1); see also subsection (a)(2)].

The Area of Potential Effect is defined as "...the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties.... The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." [36 CFR 800.16(d)]. In general, the effects on cultural resources of the various activities that are proposed for the Middle River Project Area would be:

- (1) In those stands and project areas where no historic properties (archaeological sites meeting National Register criteria) are present, proposed project activities have **No Potential to Affect** cultural resources.
- (2) In those stands and other project areas in which ground-disturbing activities would be carried out as listed above, (see Definition of Effects and Areas of Potential Effect), where historic and/or unevaluated properties are present, and where Site Avoidance (Mitigation Measure CR1) is feasible and is implemented, the proposed project activities are expected to have **No Effect** on cultural resources.
- (3) In those stands in which prescribed burning would be carried out, where historic and/or unevaluated properties are present, and where the mitigation measures described in Mitigation Measure CR2 are applied, the proposed project activities are expected to have **No Adverse Effect** on cultural resources.
- (4) Where archaeological sites occur along routes of access (such as old woods roads that have not been maintained) and where site avoidance (CR1) is not feasible, the Mitigation Measure CR5 will be applied with the expectation that a mitigation plan can be developed to result in a finding of **No Adverse Effect** on cultural resources.

Direct and Indirect Effects

With respect to the Middle River project, direct effects are those that will occur during project implementation. These effects can occur during implementation of forest management activities, as well as

during some kinds of road maintenance and construction. In essence, any activity that has the potential to disturb the ground has the potential to directly affect archaeological sites. Prescribed burning may also directly affect archaeological and architectural sites not only by construction of firelines with heavy equipment, but also by damage and/or destruction of cultural features and artifacts by the fire itself.

Summary statements of expected effects for the proposed activities within the various alternatives are presented in this section. Hill (2003) provides additional information on expected effects on individual sites and can be found in the project file.

Direct Effects

It is not expected that any of the proposed project activities, with implementation of appropriate mitigation measures, will adversely affect any of the eligible and unevaluated archaeological sites. Therefore there are no direct effects to the cultural resources from the proposed projects.

Indirect Effects

In general, project activities of the kind proposed for this project have the potential to indirectly affect cultural resources by opening up areas of the forest in which cultural resources are located to increased visitor use. Increased visitor use of an area in which cultural resources are located can render the sites vulnerable to both intentional, as well as unintentional, damage. Intentional damage can occur through the unauthorized digging in archaeological sites and unauthorized collecting of artifacts from sites.

Unintentional damage can result from such activities as driving motorized vehicles across archaeological sites, as well as from other activities that disturb the ground during dispersed recreational use.

In the case of the Middle River Project Area, increased site vulnerability is expected to be the principal indirect effect to cultural resources resulting from proposed activities. With application of appropriate mitigation measures (principally with Mitigation Measure CR1, Site Avoidance), it is not expected that the proposed project activities would increase visitor use in those areas in which archaeological sites are located. It is not expected that implementation of the proposed activities would have indirect effects on the cultural resources.

Cumulative Effects

Cumulative effects are considered only on the Middle River Project Area and for a timeframe of 10 years. This is the life of the Middle River projects. These boundaries were selected so that the cumulative effects information would be measurable and meaningful. Because it is not expected that any of the proposed project activities, with implementation of appropriate mitigation measures, will adversely affect any of the eligible and unevaluated archaeological sites, it is not expected that there will be any potential cumulative effects to the cultural resources from indirectly bringing more people into the area. It is expected that there will be no change in the condition of the cultural resources over the existing condition.

No effects to cultural resources on private lands would occur due to projects proposed on the Middle River Project Area.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

ENVIRONMENTAL JUSTICE

Existing Conditions

Presidential Executive Order No. 12898 requires Federal agencies to respond to the issue of environmental justice by “identifying and addressing disproportionately high and adverse human activities on minority and low income populations. The Middle River Project Area is only located in Callaway County. According to the 2000 Census data, 40,766 people reside in Callaway County. The data in Table 12 summarizes the general characteristics of the population group.

Table 12: Demographic of Callaway County		
Total Population	40,766	
Gender	Male	20,635
	Female	20,131
Ethnic Group	White	92%
	Black/African American	6%
	American Indian/Alaska Native	0.5%
	Hispanic	0.9%
	Other	.6%
Age	0-17 years	32%
	18-64 years	57%
	+ 65 years	11%
Per Capita Household Income	\$17,005	
Persons Below Poverty Level	8.5%	
Occupations	Employed persons +16 years	15,556
	Retail	2,210
	Health Services	2,154
	Manufacturing	2,023
	Construction	940
	Agriculture, Forestry, Fisheries	666

Callaway County has 8.5% of it's' population below the poverty level. This is lower than the Missouri average of 12.2%. Population growth from 1990 to 2000 was an increase of 24% in the county. Many persons also live in the county and commute to surrounding towns such as Columbia or Jefferson City to work.

The racial and ethnic composition of Callaway County has changed little since 1970, remaining predominately white (92%). Education levels are relatively high with 79% graduating high school and 16% with college degrees. This differs with other areas of the Mark Twain National Forest, with counties with larger unemployment rates, and higher poverty levels. Callaway County contains 7% minority populations with Missouri at 12.2%. Based on these 2000 Census figures, Callaway County has a smaller minority population than the state average and a lower poverty level. This demographic information indicates that Callaway County does not qualify as an environmental justice community.

Direct and Indirect Effects on Environmental Justice by Alternative

Alternative 1 would continue with existing grazing activities and thus would not greatly affect the local economy or employment opportunities.

Alternatives 2 and 3 would add to the local economy and employment opportunities through various contract work that may be conducted under the proposed actions.

Cumulative Effects

Cumulative effects were considered for Callaway County with a timeframe of 10 years. This is the extent that the effects are measurable and meaningful.

No negative cumulative effects were identified in any of the proposed alternatives in relation to environmental justice.

Effects including Cumulative Effects on Consumers, Civil Rights, Minority Groups and Women

Forest Service activities must be conducted in a discrimination free atmosphere. Contract work that may be generated from a decision would include specific clauses offering civil rights protection. The Forest Service would make a concerted effort to enforce these policies. Executive Order 12898 of February 11, 1994, Environmental Justice as part of the National Environmental Policy Act (NEPA), calls for consideration of the environmental, health and economic efforts on minority and low-income areas including the consumption patterns for fish and wildlife. The Middle River Area projects would have limited direct, indirect, or cumulative effects on minorities and low-income populations. The proposed actions and other alternatives do not pose a disproportionate high and adverse environmental, human health, economic, or social effect on Callaway County.

ECONOMICS

Existing Conditions

The Middle River Project Area lies in Callaway County of north-central Missouri. The area is of a rural nature but within 15 miles of Jefferson City and Fulton, Missouri. National Forest ownership in Callaway County is 12,386 about 3% of the land base of the county (539,100 acres). The county is affected by management activities on the Mark Twain National Forest through direct employment in timber harvesting, forest regeneration, wildlife habitat improvement, fencing and watershed improvement projects, and cattle

grazing permits. Indirectly, income is derived from recreation activities such as camping, hunting, hiking, mountain biking and horseback riding, wildlife viewing, etc.

In Missouri, the timber industry employs more than 33,000 people, involving nearly 2,500 firms in logging and wood products manufacturing and contribute \$3 billion each year to Missouri's economy (MDC, 2002). Approximately 3 million board feet of timber products are removed from Callaway County each year (MDC, Timber Products Output). Timber harvesting occurs primarily on private land, since the majority of the land base is in private ownership. There are only a few hardwood mills in the county, but adjacent counties provide additional mills. Cedar and other products such as firewood also play a role in the timber industry. Farming (including the grazing permits utilized on National Forest lands) and recreational uses on the district influence local economics. These lands and the trail system are popular hunting, hiking, biking and horseback riding areas for the mid-Missouri area. About one-third of Callaway County is forested (approximately 192, 000 acres). Less than 5% of the work force is employed in agriculture, forestry or fisheries within Callaway County.

Each year the National Forest returns 25% of all revenues to the states where National Forest System lands are located. This money is distributed to the counties, prorated on the number of National Forest acres in the county. These funds are used to benefit public schools and county roads. Counties with federal lands also receive payments in lieu of taxes (PILT). PILT funds are not limited to schools and roads. Minerals produced from the Mark Twain National Forest include lead, silver, copper, and zinc. The government leases the right to mine minerals to private mining companies, which in turn pay a royalty. Twenty-five percent of this royalty is also distributed to all counties that have national forest lands, regardless if mining occurs in the county. The minerals payment is to be used for schools and roads. Total payments for 2002 for Callaway County were \$29,393. (USDA, Mark Twain National Forest Annual Report, Fiscal Year 2002).

Direct and Indirect Effects on Economics by Alternative

This analysis includes only costs associated with the proposed alternatives. Since fixed costs, such as general administration and program management, do not change among alternatives, these costs are not included. Furthermore, costs included in the economic analysis are only those to be incurred by the Forest Service. Costs incurred by timber purchasers or other parties are not included. Cost estimates are based on historical costs for similar projects on the Mark Twain National Forest. All variable costs associated with each activity in each alternative were considered in the analyses except those that could not be estimated because of unknown quantities, such as law enforcement. All other project costs are considered even if they apply to all alternatives.

It is also important to recognize that many values generated by various alternatives (both positive as well as negative) involve goods and services that are not priced in the market place and are thus not represented in this comparison. These goods and services involve such things as the value of a hunting experience, a hike in the woods, wildlife viewing or the water quality of streams and lakes. There has been some research done regarding placing a dollar value on a hunting day or trip, but analyses based on this would be dependent on the type of wildlife hunted, type of hunting, etc. For purposes of this discussion, the only revenues considered are those with more finite estimates associated with timber production.

Effects on economics for each alternative, both short and long term will be discussed as it relates to employment, timber production and resulting revenues.

Employment

In Alternative 1, no timber would be harvested, so no timber harvest-related jobs would be provided. In Alternatives 2 and 3, vegetative treatments to enhance wildlife habitat would provide economic benefits beyond revenues generated by the timber sales. These benefits include employment of harvest crews, wood products industries, and the local and surrounding businesses associated with goods and services support. In the short term, income and jobs would be produced through timber harvesting, natural regeneration contracts, and fuelwood opportunities. Direct reemployment from this project can be analyzed and expressed as crew weeks. A crew week is equivalent to three individuals producing 50 thousand board feet (mbf) in a five-day week. Alternatives 2 and 3 would provide approximately 12 crew weeks of employment. Both alternatives would provide natural regeneration jobs over the next five years following proposed timber sales.

Project Revenues and Costs

Table 13 provides a comparison of economic returns by alternatives. It compares anticipated costs and revenues related to the proposed projects. It should not be considered actual yield or losses. Total cost was computed by summing up all costs of timber sale administration, road maintenance, wildlife habitat improvements, prescribed fire and other activities identified in each alternative. Total revenue was derived from multiplying estimated volumes in each alternative by estimated value. Value was derived from recent timber sales within the Houston/Rolla/Cedar Creek District.

Table 13: Economic Returns by Alternatives			
	Alternative 1	Alternative 2	Alternative 3
Cost of Preparing and Implementing Timber Sales	0	\$54,567	\$54,567
Revenues from Timber Activities	0	\$60,715	\$60,715
Net Timber Sale Revenue	0	\$6,148	\$6,148
Sale Revenue/Cost Ratio	0	1.1	1.1

Note: See Appendix D for additional details.

Alternative 1 has no timber harvest, thus no revenue. Alternatives 2 and 3 have similar timber volume at approximately 645 MBF, so the revenue/cost ratio would be the same. The cost of implementing non-timber

sale related items such as other wildlife habitat improvements, soil and water control projects, tree planting, and recreation projects carry additional cost in Alternative 2 of \$45,400 and in Alternative 3 of \$42,840. All the costs are related to present values; however, prescribed fire may be conducted several times on the Middle River Project area over the next 20 years.

Cumulative Effects on Economics

A cumulative effects spatial boundary of Callaway County and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful.

Cumulative effects of economics from past activities, the proposed action and future foreseeable actions are difficult to measure but should be similar to the past ten years. The local economy depends only on a small part on timber production from the Middle River Project Area of the Mark Twain National Forest, but more importantly on the recreational opportunities and the benefits from grazing permits, as well as the associated indirect monetary benefits from supporting these activities.

Private lands in eastern Callaway County are more heavily timbered and provide more opportunities for dispersed recreation such as hunting and timber harvests. To the south of the Project Area and along the Middle River watershed, larger farms with more cropland and pastures/hay fields will continue to contribute to the economy of Callaway County. Division to smaller homesites from farmland continues to increase on private lands, particularly along road routes and closer to population centers. With these trends, fewer private acres will be available for uses such as timber and firewood production, grazing or dispersed recreation.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

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CHAPTER 4 ADDITIONAL MANAGEMENT TOOLS USED TO ACHIEVE DFC

RANGE MANAGEMENT

Existing Conditions

The majority of the open and semi-open habitats associated with tallgrass prairie and savannah, which is the successional transition zone between prairie and forest, have been lost in the Middle River Project Area. The loss of these habitats is due to several factors. These include: removal of fire from the system, overuse of the land through intensive agricultural practices, introduction of non-native plant species, urban sprawl, etc.

As mentioned within the document previously, grazing is utilized as a tool to maintain and manage the open and semi-open habitats in the Middle River Project Area. Along with treatments such as mowing and prescribed burning, grazing contributes to maintaining a variety of openland habitat (LRMP, IV-24). Grazing within the Middle River Project Area is managed on 11 pastures for a total of 475 acres. Currently these pastures are managed under two separate Range Management Units (RMU's).

RMU 0901 is located in Compartment 9, and is comprised of approximately 270 grazed acres and is managed as a six-pasture deferred rotation grazing system. Two pastures are managed to enhance native warm season grasses and forbs; four pastures are managed for a diverse mix of cool season grasses and forbs. Carrying capacity for this RMU is estimated at 650 Animal Unit Month's (AUM's) or 2.43 AUM's per acre. Currently this RMU is grazed for six months each year from April 16 to October 15 with 60 cow/calf units for a total of 477 AUM's or 1.78 AUM's per acre.

RMU 1001, located in the southern portion of Compartment 9 and the northern portion of Compartment 10, contains approximately 205 grazed acres and is managed as a five-pasture rotation grazing system. Two pastures are managed to enhance native warm season grasses and forbs, one pasture is managed for a diverse mix of warm season grasses and cool season grasses and forbs, and two pastures are managed for a diverse mix of cool season grasses and forbs. Carrying capacity for this RMU is estimated at 628 AUM's or 3.11 AUM's per acre. This RMU is currently grazed for six months each year from April 16 to October 15 with 68 cow/calf units for a total of 540 AUM's or 2.67 AUM's per acre.

Table 14: Range Management Unit 0901 and 1001

Unit	Animal Units	Number Of Pastures	Grazing System	AUM's Grazed	AUM's Grazed/ac.	AUM's Available	Acres Grazed
RMU 901	60 Cow/Calf	6	Deferred Rotation	477	1.78	650	270
RMU 1001	68 Cow/Calf	5	Deferred Rotation	540	2.67	628	205

Grazing at less than full capacity is designed to mitigate for seasonable climatic variations such as temperature, amount and timing of precipitation, and drought regimes. Grazing at less than full capacity allows flexibility in management by: minimizing the need to reduce livestock numbers based on seasonal forage availability, such as reduced production of cool season grasses through hot summer months; and allowing for long-term sustainability of the livestock operation, forage resource, the warm season grass emphasis pastures, as well as invasive plant management. It also allows production of high quality open land habitat for wildlife.

Cool season grass species such as Tall fescue ([*Festuca arundinacea*](#)), Orchardgrass ([*Dactylis glomerata*](#)), Redtop (*Agrostis alba*), and Kentucky bluegrass (*Poa pratensis*) occur throughout the project area. Legumes such as Red clover ([*Trifolium pratense*](#)), White clover ([*Trifolium repens*](#)), Kobe lespedeza (*Lespedeza striata*), Korean lespedeza ([*Lespedeza stipulacea*](#)) and Sericia lespedeza ([*Lespedeza cuneata*](#)) are the dominant forbs in pastures managed for cool season grasses. Plant composition within cool season pastures on average is 55 to 60% Tall fescue, 10 to 15% Kentucky bluegrass, Orchardgrass, and Redtop, 25 to 35% legumes with the remainder of the herbaceous vegetation made up of other forbs such as Western ragweed ([*Ambrosia psilostachya*](#)), and Golden rod (*Solidago missouriensis*).

Warm season and other native grasses and forbs are found primarily within warm season emphasis pastures. However, scattered remnants of prairie grasses and forbs may be found throughout grazed as well as ungrazed portions of the Middle River Project Area. Native grass species within the project area include: (warm season) Big bluestem ([*Andropogon gerardii*](#)), Indiangrass ([*Sorghastrum nutans*](#)), Little bluestem ([*Schizachyrium scoparium*](#)), Sideoats gramma ([*Bouteloua curtipendula*](#)), Broomsedge bluestem ([*Andropogon virginicus*](#)), Switchgrass ([*Panicum virgatum*](#)), Eastern gamagrass ([*Tripsacum dactyloides*](#)), Prairie cordgrass (*Spartina pectinata*) and (cool season) Canada wildrye ([*Elymus canadensis*](#)). Native forbs that are present within the open and semi-open portions of the project area include: Illinois bundleflower ([*Desmanthus illinoensis*](#)), Compassplant ([*Silphium laciniatum*](#)), Butterfly milkweed ([*Asclepias tuberosa*](#)), Blazing Star ([*Liatris pycnostachya*](#)), and Partridge pea ([*Cassia fasciculata*](#)).

Maintaining a diverse openland habitat structure benefits a variety of grassland birds such as [Henslow's Sparrow](#), [Grasshopper Sparrow](#), [Dickcissel](#), [Loggerhead Shrike](#), and [Northern Bobwhite Quail](#) as mentioned in the Wildlife Section of this document. Warm season and cool season pastures are currently managed to maximize plant species diversity as well as openland structural diversity (cover). Special emphasis is also given to maintaining interstitial spaces between grasses in warm season (bunch grass) pastures and cool season grass pastures (typically sod forming grasses) and providing for covey headquarters for bobwhite quail. Interstitial spaces between grasses allow ground-nesting birds to travel freely while foraging as well as providing for a diverse forb population.

Management for diverse herbaceous plant composition within grazed areas also is beneficial to livestock performance and production. Inter-seeding legumes within cool season pastures and managed deferred rotational grazing of warm season pastures aids in the dilution of the amount of tall fescue consumed. This reduces the effects of fescue toxicity (summer slump) in cattle. Fescue toxicity is caused by a fungal endophyte found within tissues of the fescue plant. Symptoms include poor weight gains, reduced conception rates, intolerance to heat, elevated body temperature and nervousness.

Direct and Indirect Effects for Range Management by Alternative:

Alternative 1 (No Action):

Existing open land management would continue to benefit from the use of livestock grazing, within the capacity of the land. Grazing, combined with prescribed fire and mechanical treatments, are tools to provide diverse open land habitat, warm season grass pasture, control invasive plant species, and provide a sustainable forage resource. Therefore there would be no adverse effects to range management under this alternative.

Existing livestock management, animal units, season of use, number of pastures, animal unit months, and acres grazed would not change. Numbers would be the same as in Table 13 above.

Grazing and openland management would continue as is in this alternative, allowing for continued utilization for cattle forage for local landowners. However, noxious weeds would not be combated with herbicide, leading to more vigorous spread of these species into the openlands, therefore reducing quality livestock forage and wildlife habitat.

Items common to all action alternatives:

The following watershed, openland, and range improvements would occur: improvement of the road to allow livestock access to RMU 0901 pasture 5 and reduce erosion at drainage crossings, erosion control structures, pond re-construction (fenced with livestock watering tank installed), exclusion of livestock from timber and riparian areas by fencing, mechanical treatment of invasive plant species, seeding and fertilizing. These projects would reduce sedimentation in the long term, improve open-land plant structure and species diversity and provide for a sustainable forage resource.

Alternative 2: This alternative would remove approximately 40 acres of cool season pasture from grazing use over several years. This addresses the issue of reducing the amount of open/semi-openland as per the desired future condition in the Forest Plan. This reduction in grazed acres would result in the reduction of Animal Unit Months available for grazing and reduce the authorized animal units from 60 cow/calf to 51 cow/calf units. This pasture would be planted with native hardwoods as well as regeneration to hardwood forest through natural succession without use of fire, grazing and/or mechanical treatment. No new range structural improvements would be constructed. Existing range structures (fences) would be allowed to deteriorate and would be removed when livestock are excluded from this pasture.

Table 15: Range Management Unit 0901 Alternative 2

Animal Units	Season Of Use	Number Of Pastures	Grazing System	AUM's Grazed	AUM's Grazed/ac.	AUM's Available	Acres Grazed
51 C/c	4/16-10/15	5	Deferred Rotation	406	1.78	579	230

This alternative would allow for the treatment of invasive plant species with spot treatment of herbicides within native warm season grass pastures in stands 47 and 56 in Compartment 9. This treatment would

compliment existing methods of burning, mowing, and the use of livestock to reduce the spread and vigor of invasive plants present such as *Sericia lespedeza* (*Lespedeza cuneata*) and Multiflora rose (*Rosa multiflora*). Lowest levels of herbicides would reduce residues to the soil as discussed in the soil section of this document. Herbicide would be utilized only in spot treatments to combat noxious weeds and monitored for effectiveness.

Less forage for cattle would be available, reducing local landowners from utilizing this resource. The field would gradually grow into a mixture of grass species and hardwood succession species. The associated wildlife species utilizing this area would be affected.

Alternative 3: The effects of this alternative will be the same as Alternative 2 with the following exception:

This alternative maintains the existing openlands available for grazing addressing the issue raised to keep openlands available for grazing and treatment by fire and mechanical treatments. This continues to provide a diverse habitat with a variety of forbs, wildflowers and grasses.

This alternative would allow for the treatment of invasive plant species with spot treatment of herbicides within native warm season grass pastures in stands 47 and 56 in Compartment 9. This treatment would compliment existing methods of burning, mowing, and the use of livestock to reduce the spread and vigor of invasive plants present such as *Sericia lespedeza* (*Lespedeza cuneata*) and Multiflora rose (*Rosa multiflora*).

Cumulative Effects for Range Management

A cumulative effects spatial boundary of the Middle River watershed and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful.

Past actions that have affected the openland vegetation in this area have been logging prior to Forest Service ownership to clear land for openlands, farming, haying and grazing. Since government ownership, and through conversion of some of the primarily cool season grass (fescue fields) to native warm season grasses, diversity of habitats have been improved over the last 60 years. These native grass fields and the other cool season fields will continue in all alternatives, but would be reduced slightly in Alternative 2.

Private lands adjacent to the Project Area contain a mixture of pasture and hayfields, timber and homes. Probable trends on private lands would be the continuation of openlands in fescue pastures, with more farms being divided into homesites and smaller landholdings in the future. Grazed fescue pastures on private land do not provide the diversity of habitat that a mixture of warm season grasses, forbs and cool season grasses do on National Forest lands. Some wildlife habitat management on private lands near the Project Area has occurred (NRCS, 2003).

Alternative 1: Available open land for grazing would continue in this alternative, therefore providing for continued utilization for cattle forage for local landowners. Noxious weeds would continue to spread, reducing the quality of forage and wildlife habitat over the long term.

Alternative 2: This alternative would reduce the overall forage available for livestock of local landowners. As the field grows into more woody vegetation, wildlife species utilizing the area over time may be different. Reduction of non-native plants would provide more quality forage and better habitat over the long term.

Alternative 3: Cumulative effects on the grazed, openland habitat would be similar to Alternative 1, with the benefits over time from non-native plant control as mentioned in Alternative 2.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

FIRE MANAGEMENT (Prescribed Fire)

Existing Condition

The Middle River Project Area consists of forests of oak, hickory, cedar and other hardwood trees and warm and cool season grass fields. Before the onset of fire suppression, a Missouri forest typically had fewer trees, and their space was much farther apart than today's forest. Fire was and is today a natural factor to which many species and ecosystems have adapted and depend upon. Native Americans have constantly influenced plant communities and ecosystems throughout North America and the Ozark Border for thousands of years, especially through their widespread broadcasting of fire that burned across the land. Lightning fires were added ignition sources. Such fires resulted in the occurrence of fire dependent prairie's savannas and woodlands throughout Missouri.

Warm season grass has been reintroduced in part of the area and has been treated with prescribed fire past, most recently in Compartment 9 in 2001 with good results. Fuels are in the form of accumulated dead or cured leaf litter, grasses, sedges and forbs, down small twigs and sticks, fallen branches, large fallen trees, logs, stumps and dead trees or snags. This fuel varies in depth and flammability depending on the type of ecosystems presently found in the analysis area. For example, leaf litter fuels on south and west facing slopes and ridge tops are more flammable, primarily because of the amount of sunlight warming the fuels. North and east facing slopes also contain fuels that are somewhat less flammable due to the reduced amount of sunlight, which has been dominated by oak, hickory and cedar trees.

Present fuel loading includes accumulated leaf litter within the woodlands, with tight cedar thickets at edges of these woodland/field edges. Within the fields, there may be cedar trees clustered along small drainages and accumulated warm season grass and/or fescue thatch.

Within the Cedar Creek Unit, an increasing number of homes have been built near or adjacent to the National Forest. This urban interface presents challenges to land managers, including the amount of flammable fuel adjacent to private land. In the Middle River Project Area, several homes are adjacent to grass fields and woodlands.

Desired Future Condition

In the Middle River Project Area, the desired future condition regarding fire management would be to maintain open/ semi-open habitat and existing woodlands by decreasing the amount of leaf and grass litter.

This reduction of the leaf litter and matted fescue grass would increase the amount of sedges, forbs, and variety of flora available to a wide variety of wildlife. This would increase the variety of vegetation, also increasing users' enjoyment of the changing landscape. This lush green area would serve as a barrier to slow, or even in some cases, halt the forward spread for a wildfire start. The reduction in fuels generated through the use of prescribed burning would not only increase the amount of vegetation, but also reduce the amount of trees under the canopy. The removal of litter and small sized fuels helps to reduce the overall fuel loading and the potential for future larger fires.

Direct and Indirect Effects for Fire Management by Alternative

Items Common to All Alternatives

When looked at on the community level, fire carries out several functions essential to the perpetuation of many ecosystems. For example, fire is known to (1) prepare seedbeds, (2) increased species richness and cover in both openlands and forests, (3) influence the mosaic of age classes in vegetation types, (4) control plant community composition, (5) regulate the amount and type of fuel accumulation, (6) recycle nutrients, (7) increase or decrease forest insect and disease problems. The current accumulation of leaf litter has suppressed new vegetation growth, which has resulted in a reduction of under story vegetation. This blanket of leaf litter serves as a ready bed, receptive to fire starts, and ready and willing to carry a fire continuously with the ability to grow virtually unimpeded until suppression forces would arrive.

The response of grasses, sedges, shrubs, and wildflowers to fire is a function of external variables such as season of burn, fuel supply, moisture conditions and growing conditions. The timing and frequency of fire is equally important in determining plant response. This would reduce the risk associated with fire suppression efforts and help with protection of the interspersed urban interface.

Alternative 1: No action in this management area would mean that fuels would be allowed to accumulate and decompose as currently seen, particularly in the woodlands. Existing open pastures would receive periodic prescribed burning to maintain the grasses, however, no additional acres would be burned.

Fuel loadings would reach the state of theoretical homeostasis of 6 tons per acre. Wildfires in the area would remain the same and would remain moderately difficult to control. This resistance to control would continue to hamper suppression efforts and the threat to the interspersed urban interface would remain. Open/semi-open areas, outside the grazed units, would continue to be encroached upon by cedar and other woody vegetation.

Alternative 2: In this alternative the proposed projects would be implemented. Open/semi-open habitat on 400 acres would be maintained through the use of prescribed fire, mowing, and grazing. An additional 250 acres of woodland would also be treated with prescribed fire to create a mosaic effect within the ground cover and improve the diversity of plant species. Fire lines would be established. There would be approximately one mile of fire line created by means of dozer line, 4 miles of blower line, and 5 miles of fire line in the form of natural breaks, trails, roads. By initiating this alternative and removing the leaf litter and the matted fescue, there would be an increase in the diversity of plants, grasses and forbs. However, sufficient remaining leaf litter should remain within the woodlands to minimize any possible soil erosion as new plant growth is stimulated. More available sunlight to the ground surface may occur by removing shrubs and small saplings. This should stimulate an increase in plant species cover, density, and diversity.

The warm season grass component would be improved and cool season fescue grass, that is less desirable, would be reduced.

These burns may be conducted every few years with the subsequent burn frequency interval determined after evaluating previous burn results. These results depend on how each prescribed burn affects vegetation response and fuel load reduction.

Alternative 3: In this alternative, 430 acres of open/semi-open habitat would be maintained with prescribed fire and 250 acres of the woodlands being treated. Effects due to fire would be slightly more than alternative 2, but still would provide the benefits noted above.

Cumulative Effects on Fire Management

A cumulative effects spatial boundary of Callaway County and a cumulative effects temporal boundary of 10 years was selected. This is the extent that the effects are measurable and meaningful.

Past actions that have affected this area can be found in the vegetation section. Prescribed fire was used in a portion of the Middle River Project Area in 2001, primarily in the openlands, but allowed to burn within a portion of the woodlands. Growth response to the native grasses was noted. Also, fuel loading within the fingers of invasive cedars was reduced.

Much of the land base in the Middle River Project Area is in private ownership. Adjacent private lands are mostly homesites with woodlots and grazed pastures or hayfields. Most of these lands do not utilize prescribed burning as a management tool. Within five miles of the Project Area, there are approximately four private landowners who have utilized prescribed burning in management of native grasses (personal communication with Callaway County NRCS). These lands could contribute to air quality of the local area in a similar fashion as discussed in the Air Quality section of this EA, but it is unlikely that each landowner would be burning on the same day or in the same year as proposed projects in the Middle River Project Area. Vegetative effects from prescribed burning on private land and National Forest lands would contribute to improved wildlife habitat diversity.

The Reform Conservation Area, the Whetstone Creek Conservation Area, and the Little Dixie Conservation Area, managed by the Missouri Department of Conservation, are other government-managed land in Callaway County where prescribed fire would be utilized. These areas, located approximately 10 miles, 25 miles, and 20 miles, respectively, from the Project Area, would not contribute to effects from proposed management on the Middle River Project Area. Tucker Prairie, managed by the University of Missouri – Columbia, is also managed with prescribed fire, but is located approximately 25 miles to the northeast of the Middle River Project Area. As mentioned previously, on private land, it is unlikely that each of these areas would be burned on the same day or in the same year as proposed projects in the project area. The proposed Middle River prescribed burning projects would add to the overall restoration of natural functions when combined with prescribed burning on these private and state lands.

Alternative 1: Present openlands would stay similar to what they are. Woodlands would gradually become older and more closed stands with less diversity of plant species in the ground cover. Some variety of vegetation within small openings created by natural tree mortality would occur.

Fuel loading may increase as a result of continued fire suppression activities. Without treatment of the non-native and invasive species, such as Eastern red cedar, these aggressive plants would further compromise native plant communities throughout the area. They would become even more firmly established in both the openlands and forested areas.

Alternatives 2 and 3: In these two alternatives, fire would benefit the open/semi-open lands and the woodlands, increasing the diversity of ground cover and benefits to a variety of wildlife. The wildland/rural interface would also benefit with increased defensible space through fuel reduction in these alternatives.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on the fire-dependent resources in the proposed Middle River Project Area.

INVASIVE PLANT MANAGEMENT

Background

In the majority of the open lands and to some extent in the more open woodlands, non-native and invasive plants are present within the Middle River Project area. Protecting native ecosystems, through preventing new introductions of non-native, invasive plants while controlling existing populations of invasive species, is a concern for the area. These species include plants such as Multiflora rose, *Sericea lespedeza*, and Tall fescue.

The spread of invasive plants threatens the health of native ecosystems by causing changes in the composition and functioning of native plant communities. Invasive plants have characteristics that permit them to rapidly invade and dominate new areas, out-competing other vegetation for light, moisture and nutrients. Westbrooks (1998) states that solid stands of non-native plants can replace natural ecosystems and lead to extinction of native plant species, including threatened and endangered species. Invasive plants can impact soil and water resources, degrade wildlife habitat by simplifying plant communities and reducing available forage. Non-native plants, such as fescue, although used as a forage plant, can reduce tree regeneration, growth and yield. Non-native invasive plants can be a nuisance to hikers, campers, and pets and can reduce revenues from hunting, fishing, and tourism. See also discussion in the biodiversity section in Appendix C.

Invasive plants are often spread by human activities associated with vehicles and roads, agricultural practices, urban development, contaminated livestock feed, contaminated seed, and poor range management practices (Belsky and Gelbard 2000). Non-native invasive plants do not require human disturbance to become established, have few natural controls to limit their spread, and therefore pose an increasing threat to the integrity of wildland ecosystems (Olson 1999).

The term “noxious weed” is used in state and federal regulations to identify certain plants that interfere with commodity uses or cause adverse environmental, social or economic impacts. There are several species of invasive plants on the Forest that are not designated noxious weeds but are of concern because of their influence on ecosystem processes such as hydrology, fire frequency and plant productivity. In this document, the term “noxious weed” is used to refer to those species that are designated as such in the state

of Missouri. The terms “invasive exotic”, “invasive plant” or “weed” are used to refer to the broader category of invasive plant species included in the plant management program.

Forest Service policy in FSM 2259.03 states: “Forest officers should place noxious weed management emphasis on those areas where cooperative efforts are underway, such as organized weed control districts. Within budgetary constraints, the Forest Service shall control, to the extent practical, noxious farm weeds on all National Forest System lands”.

Pesticides and pesticide use is defined in the Forest Plan (LRMP, IV-23) and is a broad category that include herbicides used for undesirable plant control.

Existing Condition

There is currently no coordinated weed management program on the Mark Twain National Forest. Limited invasive plant control efforts have been utilized. Mechanical and manual treatments, prescribed burning, mowing, hand pulling, and grazing have been used to suppress some populations within the MTNF including the Middle River Project Area. Treatment with mechanical methods has proven to be labor intensive, expensive, and often not effective even with small weed populations (Tu et al., 2001)

There is a need for an integrated, environmentally safe and cost effective program to control existing populations of weeds and to prevent or reduce the potential for future infestation on the Middle River Project area. Once weed populations become large, they can only be contained through constant, long-term intervention. Complete eradication once a species is well established is extremely difficult or impossible. Prevention of spread of weeds is the most cost effective and environmentally sound control method available.

Lands within the Middle River Project Area and adjacent private lands contain non-native invasive weeds. A combination of management tools has been utilized to combat these invasive plants. Previous small tree plantings near the Middle River utilized cutting of fescue and tree shelters. This resulted in limited success to the survival of tree species planted. Other noxious weed control methods utilized in the openlands have included mechanical mowing, prescribed burning and cattle grazing. Again, limited success has occurred with the need for repeated use of these treatments.

Invasive Plant Species in Middle River Project Area

Multiflora rose (*Rosa multiflora*) is a medium height, thorny, bushy shrub that was originally introduced to the East Coast from Japan in 1886 as rootstock for cultivated roses. In the 1930's the Soil Conservation Service (SCS) advocated use of multiflora rose in soil erosion control and for living fences. It was distributed by many state conservation departments to landowners, even into the 1960's. The shrub provided escape cover and a source of winter food for wildlife. However, the species soon spread and has become a serious invader of agricultural lands, pastures and natural communities from the Midwest to the East Coast (MDC, 1997). The species was designated a noxious weed by Missouri state law in 1983.

Sericea lespedeza (*Lespedeza cuneata*) is an introduced perennial legume with erect, somewhat woody stems, standing 3 to 6 feet height. It is a native of eastern Asia. It was first introduced in the southern United States, and has now become naturalized in the East and Midwest. It was introduced into areas for soil erosion control, as food and cover for bob-white quail and turkey and to a lesser extent, for forage and hay (MDC, 1997). *Sericea* will grow in woodlands, fields, prairies, roadsides, and disturbed open ground. It

shows great resistance to summer drought and has an ability to form a dense stand. Where it has invaded grasslands, *Sericea lespedeza* is unpalatable to livestock compared to other species because of tannins present in its tissue. *Sericea lespedeza* is designated a noxious weed in Kansas; in Missouri it is considered an invasive species at this time.

Tall fescue (*Festuca arundinacea*) is a common cool-season pasture grass in Missouri. This tall, coarse grass forms dense solid stands. This hardy perennial was introduced from Europe and has been spread widely by cultivations throughout most of the United States and southern Canada. It is commonly sown for pasture and hay. It is well adapted to poor sites and was utilized by the SCS to control erosion on the Cedar Creek Unit. Fescue can crowd out native herbaceous species, while competing for moisture and sunlight with desirable native hardwood plantings.

The pictures in Appendix H show examples of plant species for control in the Middle River Project Area.

Desired Future Condition

Existing infestations of invasive non-native plants would be eradicated or controlled through coordinated use of manual, mechanical and pesticide treatments. Use of multiple tools in invasive plant management would increase the probability for successful eradication, and reduced cost and frequency of treatments.

Consistency with Forest Plan Goals and Objectives

The proposal to manage noxious weeds responds to the following goals and objectives outlined in the MTNF LRMP:

- Provide habitat for wildlife populations consistent with the goals outlined in the MTNF LRMP and consistent with other resource values.
- Pasture management for warm-season grasses may involve practices such as prescribed fire, species reintroduction and pesticide application. (LRMP IV-25)
- Use pesticides only after alternative analysis clearly demonstrates that pesticide use is the most effective means to meet overall management objectives. The analysis will consider the environmental acceptability, economic efficiency, and biological effectiveness of alternatives. Alternatives include silvicultural, mechanical, manual, prescribed fire, biological, chemical, and regulatory practices.” (LRMP, IV-23)

Direct and Indirect Effects on Invasive Plant Management by Alternative

Alternative 1:

Under the No Action alternative, current management direction would continue in the project area. A programmatic approach for controlling or eradicating invasive non-native plants and preventing new populations would not be taken. Individual populations of non-native invasive plants may be treated by various methods, such as mowing and/or burning, but herbicides would not be utilized.

Invasive species population could continue to expand and new populations could become established. Native plant communities could become less diverse. Changes in fine fuels potentially increase fire frequency, favoring the spread of exotic grasses. This alternative could result in the highest level of degradation of forage and habitat for native wildlife over the term of the analysis. Invasive plants could

continue to exist, with possible reduction with continuous mechanical treatments. This alternative would be costly due to the need for repeated treatments with limited invasive plant control.

Alternative 2: This alternative includes all integrated methods including spot foliar herbicide use within two fields to control *Serecia lespedeza* and Multiflora Rose and within 3 stands for individual tree planting to control tall fescue competition. Manual, mechanical and cultural control methods would also be used to manage existing invasive plant populations and to control new populations as they occur. Mechanical methods would include top-cutting plants through mowing and prescribed burning of infested sites. Cultural control methods would be used to encourage occupation of the Forest by desired vegetation in order to reduce the vulnerability of sites to invasion by weeds. Monitoring would occur to detect the presence and spread of invasive species.

This alternative would provide cost effective control of invasive species in the stands planted. Monitoring identified these two openlands for treatment because of their higher quality warm season grass component and the relatively small infestation of invasive plants.

Reduction of multiflora rose and *serecia lespedeza* through these treatments would provide improved openland wildlife habitat, a more diverse native plant component, and improved forage available for grazing compared to Alternative 1. Tree planting success on the proposed 45 acres would be improved by the use of spot treatment of herbicides to combat the fescue sod. See Tables 22 and 23 for further comparisons of treatments.

Effects to various other resource areas are discussed in Chapter 3.

Alternative 3: This alternative would utilize herbicides in spot foliar treatments on non-native invasive plants within two fields and to reduce competition in hardwood plantings within 2 stands. Herbicide use would be reduced because one openland area would not be planted in this alternative. An integrated approach to the management of invasive species on the Forest would be utilized. Manual, mechanical and cultural control methods would also be available for use and would be tailored to fit each specific situation. Monitoring and prevention are incorporated into this alternative, as described previously.

Effects would be similar to Alternative 2, but with fewer acres planted to trees. Therefore, fescue/grassland and forb component of Stand 14 in Compartment 9 would not be changed through the use of herbicide or tree planting. In all treatment methods, costs would be somewhat reduced because fewer acres are being planted to trees and control methods of vegetation would be reduced. See Tables 22 and 23 for further comparisons of treatments.

Items Common to Both Alternatives 2 and 3:

Complete eradication of existing non-native, invasive plant populations may be difficult to achieve. Only invasive plant populations that are small and localized within two fields and two proposed hardwood tree planting sites have been identified for eradication in the Middle River Project area.

Each year, before weed management activities would begin, an annual operating plan would be prepared by the District proposing plant treatments. If herbicides are proposed, a pesticide use proposal would be completed according to Forest Service policy (FSM 2100), and this proposal may be used as the annual operating plan. This plan would include a list of each site to be treated, method to be used, herbicide and

rate of application if applicable, map of the site and legal description, and area to be treated. (LRMP, IV-23). This plan would be reviewed by the District rangeland management specialist, wildlife biologist and/or Forest botanist to insure that the effects of the treatments would be within the scope of the analysis.

Localized populations of invasive species would be eliminated, reducing the risk for further spread. Prevention practices would minimize the introduction of new populations. Minor effects to non-target vegetation would be minimized by project design resulting in overall increases in plant diversity as invasive plants are reduced. See Chapter 3 and appendices for more information. The overall extent and occurrence of invasive plants would be reduced compared to Alternative 1. Herbicide exposure risks to wildlife would be minimal. Long-term restoration of native plant communities would increase habitat capability in infested sites.

Potential Impacts to Humans

This section will discuss the effects of herbicides on humans for both Alternative 2 and 3. Herbicide effects on health were evaluated in risk assessments completed for the U. S. Forest Service in 2003 for glyphosate (SERA, 2003) and 1996 for triclopyr (SERA, 1996). Earlier risk assessments were also utilized for these chemicals in the EA for Union Electric Right-of-Way Vegetation Management in the Mark Twain National Forest (Burns and McDonnell, 1997).

The herbicides discussed in this EA are glyphosate and triclopyr. The specimen labels and Material Safety Data Sheets (MSDS) are included in Appendix H. Numerous computerized searches were utilized to locate current literature pertaining to these herbicides.

Risk assessments to humans include the chemicals, the possible inert ingredients and their toxicity to people. Generally, the dose-response assessments used in Forest Service risk assessments adopt Reference Doses (RfDs) proposed by the U.S. Environmental Protection Agency (EPA) as indices of 'acceptable' exposure. An RfD is basically defined as a level of exposure that would not result in any adverse effects in an individual (SERA, 2003). The U.S. EPA RfDs are used because they generally provided a level of analysis, review, and resources that far exceed those that are or can be conducted in the support of most Forest Service risk assessments. Doses are expressed in several ways: as milligrams (1/1,000 of a gram) of a chemical per kilogram (1,000 grams) of body weight of the test animal (1 pound is 453.6 grams); in parts per million (ppm) in the animals diet; or in milligrams per liter (mg/l) in the air the animal breathes or in the water the animal drinks or inhabits (aquatic organisms).

The RfD of 2 mg/kg/day was proposed for glyphosate pesticide tolerances by the EPA. (SERA, 2003). The RfD for triclopyr is .005 mg/kg/day.

Inert ingredients are chemicals used with the active ingredient in preparing a herbicide formulation. They are used to provide a carrier for the active ingredient that facilitates the effective application of the herbicide. Inerts are categorized into four toxicity categories (lists) by the EPA. List 1 is inerts of toxicological concern. There are no inerts in the herbicides in the Middle River Project in List 1. List 2 contains potentially toxic inerts with high priority for testing because toxicity data is suggestive, but not conclusive, of possible chronic health effects. Kerosene is in List 2 and is included in the risk assessment for this reason (Kerosene is found in Garlon 4). List 3 contains inerts of lower priority because no evidence from toxicity data supports a concern for risk. List 4 inerts are generally recognized as safe and includes water and ethanol which are found in glyphosate and Garlon ® 3A herbicides respectively.

Table 16 lists the herbicides proposed in this EA with the amount of active ingredients as well as percent inert ingredients.

Table 16: Inert Ingredient Information			
Chemical	Percent Active Ingredient	Percent Inerts (Water)	(Other)
Glyphosate	41.5%	58.5%	0
Garlon ®3A (Triclopyr)	44.4%	44%	11.6%
Garlon ® 4 (Triclopyr)	61.6%	0	38.4% *

*Includes Kerosene

The risk assessments identified acute (single-dose), subchronic (short-term dosing), and chronic (long-term or life time dosing) laboratory toxicity studies of effects caused by dermal (applied to skin), inhalation (exposure to vapors or aerosol particles), and ingestion (fed in the diet) exposures. Threshold toxicity values that included acute oral LD₅₀'s (median lethal dose) and systemic and reproductive no-observed-effect levels (NOEL's) were determined for each herbicide.

The acute toxicity studies are used to determine the toxicity reference level known as the median lethal dose (LD₅₀). The LD₅₀ represents the dose that kills 50 percent of the test animals. The lower the LD₅₀, the greater the toxicity of the chemical. The LD₅₀ ranges and toxicity categories used in the risk assessment (SERA, 2003, 1996) and those of the EPA classification system (reference MSDS) using rat oral LD₅₀'s as shown in Table 17.

Table 17: Acute Toxicity Classification and Acute Toxicities in Relation to Other Common Chemicals			
Toxicity Category ¹	Herbicide or Other Chemical Substance	Oral Ld ₅₀ for Rats (mg/kg)	Equivalent Human Dose
IV – Very Slight	Kerosene	16,000-23,000	More than 1 pint
	Ethyl alcohol	13,700	
III – Slight	Glyphosate	2,000-6,000	1 ounce to a pint
	Table Salt	3,750	
	Aspirin, Vitamin B ₃	1,700	
	Triclopyr	300-1,000	
II – Moderate	Caffeine	200	1 teaspoon to 1 ounce
I – Severe (danger-poison)	Nicotine	50	1 teaspoon or less

¹Categories and LD₅₀ ranges are based on a classification system used by the EPA for labeling (USDA, 2003, USDA, 1996, and USDA, 1989)

Subchronic studies are used to determine the toxicity reference level called the no-observed-effect level (NOEL). This is the highest dose level at which no toxic effects are observed. Subchronic studies, normally using lower doses levels than acute studies, provide information about systemic effects, cumulative toxicity, the latency period (the time between exposure and the manifestation of a toxic effect), the reversibility of toxic effects, and appropriate doses ranges to use in chronic tests.

Herbicide exposures and the resultant doses to workers and to the public were estimated in the exposure analysis. Exposure scenarios were used to estimate a range of possible exposures including typical and maximum. The risk analysis compared doses to NOEL's and LD₅₀'s and discussed probability of acute and chronic effects for typical through maximum scenarios. Risk judgments are based on the magnitude of the ratio between the laboratory doses and the estimated human doses. This is referred to as the margin of safety (MOS). The larger the MOS, the lower the risk to human health. In general, MOS's of 100 or greater indicate negligible risk to workers and the general public (USEPA, 1986).

The indicators for human risk are as follows: negligible risk is when an MOS exceeds 1,000; low risk is when an MOS is between 100 and 1,000; high risk is when an MOS is between 1 and 100. The indicators for wildlife toxicity are: very slight toxicity is an LD₅₀ from 5,000-50,000 and slight toxicity is an LD₅₀ from 500 –5,000. The indicators for aquatic life toxicity are: practically non-toxic is an LC₅₀ greater than 100 parts per million (ppm) and slightly toxic is an LC₅₀ between 10 ppm and 100 ppm. (LC₅₀ represents the concentration of a toxicant in water that is lethal to 50 percent of the population of test organisms within a specific period of time, usually reported for 96 hours).

Cancer Risk

Triclopyr and glyphosate were not found to cause cancer in laboratory animal studies (USDA, 2003 and USDA, 1996). All risk values were found to be less than one in ten million. Putting cancer risks into perspective with everyday activities: motor vehicle accidents have a risk of fatality that averages two in 10,000 per person per year. Over a 30-year period, the cumulative risk would be six in 1,000. Hazards that have a cancer risk of about one in one million include smoking two cigarettes, drinking 40 sodas sweetened with saccharin, or taking one transcontinental round trip by air.

Spill Risk Analysis

The risk assessments discuss risk to the public from accidents and spills. It was noted that these are one-time, rather than repeat, or chronic, exposures and that comparison of these doses with acute LD₅₀'s shows that no one is likely to be at risk of fatal effects.

Risk of Synergistic Effects

Synergistic effects of chemicals are those that occur from exposure of two chemicals either simultaneously or within a relatively short period of time. Synergism occurs when the combined effects of the chemicals is greater than the sum of the effects of each chemical separately. The herbicide mixtures proposed in the Middle River Project Area have not shown to have synergistic effects in humans.

Handling and Storage

Proper handling and storage guidelines that are specific for the proposed herbicides would be followed. Proper personal protective equipment (PPE) would include long-sleeved shirt and long pants, boots with socks, chemical resistant gloves, and protective eyewear. Other safety precautions include those in Table 18. These were obtained from the MSDS sheets, which are contained in Appendix H.

Table 18: Proper Handling/Storage Guidelines			
	Glyphosate	Garlon 3A	Garlon 4
Wear protective eyewear when handling		X	X
Avoid breathing fumes from burning materials		X	X
For handling prior to end-use, use gloves impervious to this material when prolonged or repeated contact could occur		X	X
Provide general and or/or local exhaust ventilation to control airborne levels below the exposure guidelines		X	X
For handling end-use product, applicators and other handlers must wear long-sleeved shirt and long pants, shoes and socks.	X	X	X
No special ventilation precautions recommended	X		
Avoid sources of ignition if temperature is near or above flash point		X	X
Do not use near heat, sparks, or open flame			X
Stable under normal conditions of warehouse storage	X	X	
Store above 10 ° F	X		
Store above 28° F or agitate before use.		X	X
Do not contaminate water used for irrigation or domestic uses		X	X
Do not apply directly to water	(aquatic label as needed near water)	X	X

Summary of the Human Health Analysis

The human health risk assessment consists of comparing doses that people may receive from applying the herbicides (doses to workers) or from being near an application site (doses to the public) with doses that have produced no observed toxic effects in test animals in controlled laboratory studies. The results are shown in Table 19.

Table 19. Lowest Margin of Safety (MOS) for the Public from Typical Exposures in Routine Operations		
Chemical	Typical Exposures	
	Systemic	Reproductive
Glyphosate	10,000	10,000
Triclopyr (amine) Garlon 3A	1,000 (DEO)	1,045 (DEO)
Triclopyr (ester) Garlon 4	3,900 (DEO)	3,910 (DEO)

DEO: Dermal exposure – onsite

(SERA 2003, 1996)

Comparison of estimated typical exposures with laboratory toxicity levels indicates that no member of the public should be affected by the herbicides or associated chemicals proposed for spot treatments in the Middle River Project Area. The lowest MOS is 1,000. This is much greater than the 100 mark, which indicates negligible risk by the EPA.

Workers are at greater risk of systemic and reproductive effects than members of the public. As reported in Burns & McDonnell, for a typical exposure, the MOS's are well over 100 (1997). However, this is based on maximum exposures with a series of assumptions (highest acres treated at highest dose with highest drift possible and longest work hours predicted). This assessment was also based on broadcast spraying. The probability of workers receiving repeated doses as high as predicted in Burns & McDonnell (1997) is extremely low. The risk assessment for triclopyr (USDA, 1996) also documents that no workers or members of the public would approach the exposure level that would cause any health effects. Treatments in the Middle River Project Area would only be spot treatments for a total treatment area of less than 5 acres, with minimum risk to workers or the public.

Wildlife and Aquatic Species Risk Analysis

The risk analysis considers potential wildlife and aquatic species impacts of using the two herbicides being considered for use in the Middle River Project Area. Wildlife and aquatic species risk from vegetation management with herbicides is a function of the inherent toxicity (hazard) of each herbicide to different organisms and of the exposure level to each chemical.

Wildlife and Aquatic Species Hazard Analysis

The hazard analysis summarizes the findings of laboratory and field studies that indicate the toxicity to wildlife and aquatic species of the herbicides proposed to be used in the Middle River Project Area. Table 20 shows the acute toxicity of the herbicides to various test animals.

Table 20: Characteristics of Herbicides			
Chemical	Oral LD₅₀ (mg/kg) or LC₅₀ (ppm)		
	Rat	Rabbit	Bobwhite Quail
Glyphosate	>5,000	>5000	NA
Triclopyr (amine)	2,830	N/A	LC ₅₀ = 2935
Triclopyr (ester)	2,140	N/A	NA

(SERA, 2003 and 1996)

In the aquatic risk analysis the relative acute toxicities of the herbicides are classified by their LC₅₀ value. It represents the concentration of a toxicant in water that is lethal to 50 percent of a population of test organisms within a specific period of time (usually reported for 96 hours). An LC₅₀ value of 100 ppm or higher is considered practically nontoxic. Glyphosate is >1,000 LC₅₀ to bluegill and triclopyr is > 100 LC₅₀ for bluegill (SERA 2003, 1996). Treatments with triclopyr would occur in two upland fields, not located

near aquatic resources. Treatment of fescue for planting hardwoods near Middle River with glyphosate would have little effect on aquatic plants or fish. The aquatic formulation of glyphosate would be utilized in these spot treatments as discussed in the Soils section in Chapter 3.

Wildlife and Aquatic Species Exposures

Wildlife exposures were calculated for a group of wildlife and aquatic species representative of those typically found in areas supporting forest vegetation similar to that in the MTNF. Acute exposure estimates were made for each representative species for each of the three major exposure routes: inhalation, dermal, and ingestion. Due to the fact that these herbicides degrade rapidly, that sites are treated only once in a given year or less, and that application may only occur twice in ten years, there was no analysis of chronic wildlife dosing. Based on the available toxicity data and the proposed application rates, the risks to wildlife from the use of the herbicides included in the analysis are low to negligible (SERA 2003, 1996).

There are no cumulative effects expected to wildlife and aquatic species from herbicides since they do not bioaccumulate in animal tissue and have a low to negligible toxicity at the proposed application rates.

Water Quality and Soil Resources related to Herbicides

Effects to soil resources and water quality are also discussed in Chapter 3 of this EA. The important characteristics of each herbicide's potential effects on the environment are listed in Table 21.

Table 21: Characteristics of Herbicides							
Chemical	Solubility (ppm)	Half-life (Days)	Photo Degradation	Microbial Degradation	Hydrolysis	LD ₅₀ ¹	LC ₅₀ ²
Glyphosate	12,000	61	Minor	Yes	No	4,320	>1,000
Triclopyr	430	10-46	Rapid	Yes	No	1580	148

1: Technical grade for rats

(SERA 2003, 1996)

2: 96 hours, bluegill or sunfish

Herbicides are subjected to natural processes once they are applied to a site. The result of the natural processes is the decomposition of the herbicides. Their decomposition is a result of transportation and degradation. Transportation includes drift, wash off, volatilization, plant uptake, leaching, surface runoff, and subsurface flow. These movements are discussed in more detail in the soil section in Chapter 3.

Glyphosate: The formulation is soluble in water, but glyphosate is strongly absorbed in the soil and not soil active. The herbicide is readily absorbed and translocated within plants but is not metabolized. The major degradation pathway is microbial breakdown in the soil. It is low in toxicity to aquatic and terrestrial organisms (SERA, 2003).

Triclopyr: It is readily absorbed by roots and foliage and translocates easily to meristems. It is metabolized by bacteria and photo-degrades rapidly. Its half-life is less than 10 hours in water but it is more persistent in soils. It is moderately soluble and not strongly adsorbed in the soil. Triclopyr is low in toxicity to wildlife and fish (SERA, 1996).

There should be no cumulative effects on water quality or soil resources given the low application rates and limited amount of areas treated. Cumulative effects are discussed in Chapter 3 on these resources. Mitigation measures discussed in chapter 2 would also reduce any impacts. At the limited spot treatments proposed in this project, there would be very few impacts to water quality or soil resources from herbicide use.

Tables 22 below displays an economic comparison showing control methods for invasive plants in the Middle River project area.

Table 22: Weed Control Methods Comparison

	Estimated Cost*	Multiflora Rose	Serecia Lespedeza	Tall Fescue in Hardwood Planting Sites
1. Hand Pulling/Digging	\$10,000 estimated labor costs for 2 persons	1. Highly labor intensive	1. Highly labor intensive.	1. Not effective due to tough root system and labor intensive.
2. Mowing	\$9,000 estimated cost over 10 year period	2. Plants sprout from roots; Need to be repeated 3-6 times per year for up to 4 years. Can be utilized in combination with other methods such as prescribed fire and herbicide treatments. Cost of approximately \$60/acre to do spot mowing each treatment. Needed 3-6 times per year to be effective. Repeat for up to 4 years.	2. Mowing in flower bud stage for 2-3 consecutive years will reduce vigor. Can be utilized in combination with other methods such as grazing and herbicide. Cost of approximately \$60/acre to do spot mowing per year. Repeat for 3 years.	2. Mowing needed to be utilized on year prior to planting for approximately \$50/acre. Repeated on a limited basis yearly. Mowing often stimulates fescue. Labor intensive.
3. Mulching	NA	3. Not feasible on this species.	3. Not feasible on this species.	3. Mulching could be utilized after initial vegetation controlled.
4. Grazing	NA	Cattle do not graze on multiflora rose stems.	Serecia plants palatable to cattle in early summer, after prescribed burning or mowing in previous year; cattle do not graze this species later. Use with mowing and/or herbicide methods.	Grazing not utilized in tree planting sites to protect seedlings.

Table 22: Weed Control Methods Comparison

	Estimated Cost*	Multiflora Rose	Serecia Lespedeza	Tall Fescue in Hardwood Planting Sites
5. Prescribed Fire	Estimated cost of \$17,000 (burning on 59 acres three times in a 10-year period)	Prescribed burn within openlands areas rarely kills Multiflora Rose. Cost of approximately \$100/ acre. Treatment repeated every 3 years.	Prescribed burns must be combined with mechanical or chemical to be effective or seed germination stimulated by fire will increase spread.	Damage to seedlings trees; not utilized in these areas
6. Biological Control (Not used on the MTNF at this time)	NA	Rose rosette disease (RRD is killing Multiflora rose. Mowing seems to be enhancing spread of RRD.	Research on-going; possibility of webworm, but limited effectiveness at this point.	Not utilized on this forage grass.
7. Spot Herbicide Use	Estimated range of \$900 to \$1500 over the 10 –year period.	Glyphosate could be utilized for a cost of approximately \$80/acre. Spot foliar treatments may be needed 2 times in a 10-year period.	Triclopyr could be utilized for a cost of approximately \$100/acre. Spot foliar treatments may be needed 2 times in a 10-year period.	Glyphosate could be utilized for a cost of approximately \$80/acre. Spot foliar treatments utilized fall prior to planting.

* Spot treatment of herbicides would involve less than 5 acres total in the Project Area, but 5 acre figure was used for the analysis.

Tables 23 below displays pros and cons of invasive plant control methods in the Middle River project area.

Table 23: Invasive Plant Control Methods Pros and Cons Analysis		
	Pros	Cons
1. Hand Control (Dig/Pulling)	Quick Results; Selective; No Equipment Investment; No Management Restriction (such as grazing restriction)	Limited to woody stems (not used for sod grass such as fescue); Labor Intensive; Requires Repetitive Application
2. Mowing	Faster than Hand Control; Fair Results with Repeated Treatments: Equipment Readily Available	Many Repetitions Needed to be effective; Timing Critical to be effective; Limited/poor Effectiveness; Large Equipment Investment High Equipment Maintenance Cost; Non-plant Specific; Reduces Vegetation Structure; Reduces Available Forage
3. Mulching	NA	
4. Grazing	Provides Limited effectiveness on Serecia; Develops Vegetation Structure: Readily Available Benefits to grazing permit tees	No Multiflora Rose Control; Limited Overall Effectiveness. Does not control fescue in hardwood plantings.
5. Prescribed Fire	Benefits Other Plants	Limited Effectiveness especially as a sole treatment
6. Biological Control	NA	
7. Spot Herbicide Use	Effective Control of Target Plants; Very Selective Control: Reduces Labor Intensity; Longer Treatment Window compared to other treatments	Short Public Exclusion Period; Short Grazing Restriction Period; Required Certified Applicator Supervision

Overall Summary of Invasive Plant Management

Because herbicides better control vegetation, subsequent treatment within the ten-year planning period would be reduced, compared to other methods. Hand clearing and prescribed burning would be the most costly. This is primarily due to the time investment for both of these methods. Mechanical methods are more expensive than the spot herbicide treatments proposed, mostly because of the time factor and equipment costs.

Cumulative Effects for Invasive Plant Management

A cumulative effects spatial boundary of the Middle River Project Area and a cumulative effects temporal boundary of 10 years were selected. These boundaries are meaningful and measurable for the invasive plant management program identified in this project.

Past Forest Service actions related to invasive plant management have included identification of species of concern with the project area and within the Houston/Rolla/Cedar Creek District. Mowing and selective grazing have been utilized to reduce the amount of seed spread for serotia lespedeza and to reduce Multiflora Rose. Within some previous tree planting areas, fescue sod has been cut and tree shelters placed around hardwood trees planted. Herbicides had been utilized for some spot treatment of Multiflora Rose control on the Cedar Creek Unit approximately 15 years ago. Prescribed burning has been utilized in Compartment 9 in some of the openlands and woodlands, but not in Compartment 10. Past land activities on private lands has included use of herbicides and pesticides in primarily agricultural uses. More discussion is also found in the other sections in Chapter 3.

Active treatment of invasive plants through a combination of mowing, grazing, herbicide use, cultural methods, and burning would reduce the overall amount of invasive plants into the future. As increasing information is available to private landowners, more control of these species may occur on private land, combining to reduce their overall pervasiveness in the environment. Many landowners and farmers presently utilize some of these same methods, including herbicides, in the management of their farms, particularly in the control of Multiflora Rose.

Cumulative herbicide effects are not likely to occur because none of the herbicides are persistent in the environment or in the human body. No member of the public is likely to be chronically exposed through the Middle River Project spot herbicide treatment because the program would be on a ten-year plan and there would be no accumulation of chemicals in the environment.

Alternative 1: Present methods utilized in the openlands would continue with some limited reduction in the spread of invasive plants.

Alternative 2 and 3: These alternatives would both reduce the amount of invasive plants within the next 10 years with a combination of treatments. As more native vegetation is present, the diversity of wildlife habitat would increase, available forage would be improved and the diversity of native plants would improve the overall ecosystem health.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

Monitoring

Project level monitoring is designed to determine whether or not the resource management objectives of the EA have been implemented as specified and whether or not the mitigating measures were effective. These help determine if management activities are meeting the direction of the Forest Plan. Monitoring and evaluation help improve management and planning decisions.

Forest-wide project monitoring would be conducted by MTNF Resource Staff on a sample of randomly selected project areas on an annual basis. The Middle River Project Area could be included in this sample at any time and stage of the project planning and implementation process.

Air Monitoring:

Monitoring of prescribed burning would occur according to the mitigation measures.

Timber and Soil/Water Monitoring: Implementation monitoring of project mitigation measures and other project actions would be conducted by the timber sale administrator.

Wildlife Monitoring:

Ensure that mitigations are followed regarding tree retention.

Monitor population levels in cooperation with other agencies.

Ensure that prescribed burning follow mitigation measures regarding wildlife nesting.

Visuals Monitoring:

Ensure that visual mitigations are being implemented.

Non-native and Invasive Weed Monitoring:

Undesirable plants surveys would document locations of these plants and where treatments have occurred. Surveys would be updated on an annual basis to monitor the effectiveness of control and possible new infestations.

Herbicide use reports would be completed at the end of the treatment season.

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CHAPTER 5. PROJECT COORDINATION

Table 24: Preparers and Contributors

Interdisciplinary Team Members			
Name	Expertise	Professional Discipline	Natural Resource Experience
Klaus Leidenfrost	Wildlife Management	B.S Wildlife Science Purdue University W. Lafayette, IN	24 years
Mark Hamel	NEPA	B.S Forestry University of Wisconsin Madison, WI	20 years
Doyle Henken	Silviculture	B.S. Forestry Southern Illinois University, Carbondale, IL	26 years
John DePuy	Soils Resources	B.S. Forestry M.S. Forest Ecology Southern Illinois University, Carbondale, IL	25 years
Carol Trokey	Recreation Economics Environmental Justice	B.S. Forestry M.S. Forestry University of Missouri Columbia, MO	22 years
Marge VanPraag	Visual Resources	B.L.A. Landscape Architecture University of Illinois- Champaign/Urbana	14 years
Kristina Hill	Heritage Resources	B.A./M.A. Anthropology University of Missouri Columbia, MO	5 years
Amy Sullivan	Transportation System	B.S. Civil Engineering P.E. University of Missouri Rolla, MO	16 years
Steve Herndon	Non-native Invasive Plant Species/Range	B.S. Agriculture, Natural Resources Lincoln University Jefferson City, MO	9 years
Tom Graver	Fire Management	AAS Forestry	16 years

Table 25: Ad-Hoc Members

Name	Expertise	Professional Discipline	Natural Resource Experience
Bruce Gibson	Heritage Resources	B.A. Antropolgy, SIU, Edwardsville, IL B.A. Botany, M.S. Plant Biology SIU, Carbondale, IL	6 years
Paul Nelson	Fire Ecology	B.S. Wildlife Management SW Missouri State- Springfield Masters –Botany Southern Illinois University, Carbondale, IL	27 years
Bob Glock	Timber Management	B.S Forestry University of Missouri, Columbia, MO	29 years
Frank Chrismer	Geographic Information	B. S Forestry Minor Biology Stephen F. Austin State Univercity Nacogdoches, TX	12 years
Troy Crowe	Vegetation	B.S. Forestry Environmental Studies Minor Southern Illinois University, Carbondale, IL	3 years
Larry Furniss	Fisheries	B.S. Forestry Mississippi State Masters Wildlife Louisiana State Minor-Fisheries Arkansas State	28 years

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US Fish and Wildlife Service, Columbia, MO

State Historic Preservation Office, Missouri Department of Natural Resources, Jefferson City, MO

Missouri Department of Conservation, Wildlife Division, Columbia, MO

Missouri Department of Natural Resources, Jefferson City, MO

APPENDICES

Appendix A: References

Appendix B: Glossary

Appendix C: Biological Diversity

Appendix D: Economic Analysis Tables

Appendix E: Soil Characteristics Tables

Appendix F: Middle River Project Maps

Appendix G: Biological Assessment / Biological Evaluation/Fish and Wildlife Service Consultation

Appendix H: Herbicide Labels, Material Safety Data Sheets, Treatment Area Photos

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APPENDIX A

References

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Soils Reference List:

- Alban, David H. 1977. Influence on soil properties of prescribed burning under mature red pine. USDA For. Serv. Res. Pap. NC-139. 8pp. illus. North Cent. For. Exp. Stn., St. Paul, Minn.
- Amelon, Sybill K. 1991. Productivity and nutrient cycling responses to prescribed fire in a glade ecosystems. Thesis. University of Missouri – Columbia. 237 pages.
- Boyle, Michael. 2002. Erosions's contribution to greenhouse gases. *Erosion Control: Volume 9, Number 1*, pp. 64 – 67.
- Buol, S.W., F.D. Hole, R.J. McCracken, & R.J. Southard. 1997. *Soil Genesis and Classification*, 4th edition. Iowa State University Press, Ames, Iowa. 527 pages.
- Cunningham, Bob and Carl Hauser. 1989. The decline of the Missouri Ozark forest between 1880 and 1920. In Thomas A. Waldrop (editor). *Proceedings of Pine-Hardwood Mixtures: A Symposium on Management and Ecology of the Type*. 1989 April 18 – 19. Atlanta Georgia. . General Technical Report SE-58. Asheville, NC: USDA, Forest Service, Southeastern Forest Experiment Station pp. 34 - 37.
- DeBano, Leonard F., Daniel G. Neary, & Peter F. Ffolliott. 1998. *Fire's effect on ecosystems*. John Wiley & Sons, New York. 333 pages.
- Elliot, Bill, USFS Soil & Water Engineering, Moscow, ID. 12/12/2002. Forest Service WEPP interfaces. On line at <http://forest.moscowfsl.wsu.edu/fswepp/>
- Elliot, William J., David E. Hall, & Dayna L. Scheele. February 2000. Disturbed WEPP (Draft 02/2000) WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery: Technical Documentation. Available on line: <http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html>
- Fisher, Richard F. and Dan Binkley. 2000. *Ecology and Management of Forest Soils* (3rd edition). John Wiley & Sons, Inc. New York. 489 pages.
- Godsey, Kevin. 2000. Effects of fire on an oak-hickory forest in the Missouri Ozarks. M.S. thesis. University of Missouri. 125 pages.
- Heikens, Alice Long. 1999. Savanna, Barrens, and Glade Communities of the Ozark Plateaus Province. In Anderson, Roger C., James S. Fralish, and Jerry M. Baskin (eds.). *Savannas, Barrens, and Rock Outcrop Plant Communities of North America*. Cambridge University Press, New York, N.Y. Pages 220 – 230.
- Jacobson, Robert B. and Alexander T. Primm. 1994. Historical Land-Use Changes and Potential Effects on Stream Disturbances in the Ozark Plateaus, Missouri. U.S. Geological Survey Open-File Report 94-333. USDI U.S. Geological Survey, Rolla, MO. 95 pp.

Keefe, J.F. 1987. The First Fifty Years – Missouri Department of Conservation. Conservation Commission of Missouri. Jefferson City, MO. 446 pages.

Law, Jay. 1992. The development of Modern Management. Pp. 20 – 34. . In Alan R.P. Journet and Henry G. Spratt, Jr. (eds.) Toward's a Vision for Missouri Public Forests. Proceedings of a Conference at Southeast Missouri State University, Cape Girardeau, MO.

Luckow, Ken. 2000. Effects of shortleaf pine –bluestem-ecosystem restoration on soil quality on the Ouachita National Forest – and implications for improved water and air quality and watershed condition. USDA Forest Service. Ouachita National Forest. 16 pages.

Luckow, Kenneth. 2000. Effects of shortleaf pine-bluestem ecosystem restoration on long-term soil productivity on the Ouachita National Forest. USDA Forest Service. Ouachita National Forest. 24 pages.

Luckow, Kenneth. 2000. Pine – Bluestem Restoration and Soil Quality. Power Point presentation. 30 slides.

Nigh, Tim. 1992. The Forests Prior to European Settlement. Pp. 6 – 13. In Alan R.P. Journet and Henry G. Spratt, Jr. (eds.) Toward's a Vision for Missouri Public Forests. Proceedings of a Conference at Southeast Missouri State University, Cape Girardeau, MO.

Nigh, Timothy and Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, MO. 212 pages.

Peterson, D.L. and G.L. Rolfe. 1982. Precipitation Components as Nutrient Pathways in Floodplain and Upland Forests of Central Illinois. Forest Science 28: 321-332.

Pierzynski, Gary M., J. Thomas Sims, & George F. Vance. 2000. Soils and Environmental Quality, 2nd edition. CRC Press, New York. 459 pages.

Poeschl, Harold J. 1977. Application of the Universal Soil Loss Equation on Forested Land. Pages 83 – 103. In G.M Aubertin (editor) "208 Symposium Proceedings: Non-point Sources of Pollution from Forested Land.

Pritchett, William L. and Richard F. Fisher. 1987. Properties and Management of Forest Soil, 2nd edition. John Wiley & Sons. New York. 494 pages.

Schlesinger, William H. 1997. Biogeochemistry: An Analysis of Global Change. (2nd edition. Academic Press. New York. 588 pages.

Schoolcraft, H.R. 1821. Journal of a tour into the interior of Missouri and Arkansas in 1818 and 1819. London. Reprinted in 1955 by Argus Press-Argus Printers, Van Buren, AR. Cited within Scrivner, C. L.. Soils of Missouri: A guide to Their Identification and Interpretation. Extension Division. University of Missouri. 48 pages.

Scrivner, C.L., J.C. Baker, & B.J. Miller. 1966. Soils of Missouri: A Guide to Their Identification and Interpretation. University of Missouri, Extension Division, Columbia, MO. 47 pages.

Soil Survey Division, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions [Online WWW].
Available URL: "<http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdlist.cgi>" [Accessed 23 Mar 2001].

Soil Survey Division, Natural Resources Conservation Service, United States Department of Agriculture. USDA-NRCS NASIS Pangaea Reports. Available online at:
<http://nasis.usda.gov/cgi-bin/reportest.cgi?-R>

Troeh, Frederick R., J. Arthur Hobbs, and Roy L. Donahue. 1991. Soil and Water Conservation, 2nd edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. (citing page 115). 530 pages.

USDA, Forest Service. 1981 Mark Twain National Forest. Ecological Classification System for the Salem-Potosi District. 145 pages.

USDA, Forest Service. Mark Twain National Forest. 2001. Watershed Assessment Report. Forest – Wide Assessment.

USDA Forest Service. Mark Twain National Forest 2002. Environmental Assessment of the Forest-Wide Pine Fuel Reduction Project (draft). 165 pages.

USDA, Forest Service, Washington Office. 1999. Road Analysis: Informing Decisions About Managing the National Forest Transportation System. Miscellaneous Report FS-643. Washington, D.C.

USDA Forest Service, Rocky Mountain Research Experiment Station... 2003. Hayman Fire Case Study Analysis Report. Available on line at: www.fs.fed.us/rm/hayman_fire/.

Van Lear, David H. and Peter R. Kapetuck. 1989. Fell and burn to regenerate mixed pine-hardwood stands: an overview of effects on soil. In Thomas A. Waldrop (editor). Proceedings of Pine-Hardwood Mixtures: A Symposium on Management and Ecology of the Type 1989 April 18 – 19. Atlanta Georgia. . General Technical Report SE-58. Asheville, NC: USDA, Forest Service, Southeastern Forest Experiment Station. pp. 83 – 90.

Weaver, G.T. and R.G. Brown. 1978. Stability of pH Hydrogen–Ion Concentrations and Nutrient Concentrations in Precipitation in Field Collections in Forest Ecosystems. Pages 59-61 in Agricultural Review of Southern Illinois. SIU Carbondale, School of Agriculture.

Air Reference List:

Clean Air Act, as amended 1990 (42 U.S.C. 7401 et. Seq.).

Heritage Reference List:

Gibson, Bruce. 2003 Complete Coverage Survey Report for Middle River Project, Callaway County, Missouri. Mark Twain National Forest Cultural Resources Reconnaissance Report #R2004-09-05-08-030.

Hamby, Brooke. 2002. Archaeological Investigations at The Celia Site (23CY497): Mark Twain National Forest, Callaway County, Missouri. Department of Anthropology, University of Tennessee, Mark Twain National Forest Report #R2002-09-05-08-0255.

Harris, Suzanne. 1984. *R-9 Cultural Resource Reconnaissance Report for Middle River Clay Pits*. Mark Twain National Forest, CRR No. 09-05-08-08.

Hill, Kristina. 2003. USDA Forest Service, Mark Twain National Forest. Determination and Eligibility and Effects on the Middle River Project Area. Report submitted to the Missouri Department of Natural Resources State Historic and Preservation Office.

Klinger, Timothy C. and Richard P. Kandare. 1988 Cedar Creek, Houston, and Rolla Ranger Districts 1984-1985. Historic Preservation Associates Reports 88-5, Fayetteville, Arkansas.

Yelton, Jeffery K. and Mark L. Parsons. 1992 A Cultural Resources Survey of Location in Butler, Callaway, Crawford, Dent, Douglas, Iron, Oregon, Ozark, Reynolds, Ripley, Shannon, Ste. Genevieve, Taney, Washington, and Wayne Counties in the Ava, Cedar Creek, Doniphan, Eleven Point, Fredericktown, Poplar Bluff, Potosi, Salem, and Willow Springs Districts, Mark Twain National Forest, Missouri: 1992. Center for Archaeological Research, Southwest Missouri State University, Springfield, Missouri.

Range Management Reference List:

Johnson, D. H., and L. D. Igl (Series Coordinators). 2001. Effects of management practices on grassland birds. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/literatr/grasbird/grasbird.htm> (Version 04SEP03).

Vegetation, Recreation, and Economics Reference List:

Cordell, H. Ken; Teasley, Jeff R.; Bergstrom, John C.; Betz, Carter J. 1997a. National Survey on Recreation and the Environment - participation, trips, days, and favorite activities data sets. CD-ROM. Athens, GA; U.S. Department of Agriculture, Forest Service, Southern Research Station; University of Georgia, Department of Agriculture and Applied Economics.

Kingsley, Neal P. and Jay R. Law. 1991. Timber Resource of the Mark Twain National Forest. Resource Bulletin NC-129, St. Paul, MN: USDA, Forest Service, North Central Forest Experiment Station, 31 p.

Larsen, David R.; Loewenstein, Edward F.; Johnson, Paul S. 1999. Sustaining Recruitment of Oak Reproduction in Uneven-aged Stands in the Ozark Highlands. Gen. Tech. Rep. NC-203. St. Paul, MN: U.S. Department of Agriculture, North Central Research Station, 11 p.

Larsen, David and Ed Loewenstein. 1998. Missouri Silviculture: Uneven Size Distribution Calculations. Available online at: <http://www.snr.missouri.edu/silviculture>

Missouri Department of Conservation, 2003, Forest Products Output, available online at: <http://conservation.state.mo.us/forest/products>

United States Census Bureau, State and County QuickFacts. Available online at: <http://quickfacts.census.gov/qfd/states>

USDA Forest Service, 2003. Mark Twain National Forest Annual Report, Fiscal Year 2002, 6 p.

Fisheries and Wildlife Reference List:

Amelon, Sybil. 2003. Preliminary Summary Report of Bat Monitoring for Cedar Creek Ranger District, Mark Twain National Forest. USDA Forest Service, North Central Research Station, Columbia, MO 14 pp.

Bruendermann, S.A, J.S. Faiman, A.C. Buchman. 2001, Survey for Endangered and Other Unionid Species in the Upper Gasconade River Basin, Missouri. Missouri Department of Conservation, 1000 South College Ave. Columbia, MO 65201 97 pp.

Herkert, J.R. 2001. Effects of management activities on grassland birds: Henslow's Sparrow. North Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND. 17 pages.

Hickey, E. 1994. 1992 – 1994 Summary Report Establishment of Experimental Populations of Running buffalo Clover *Trifolium Stoloniferum* on the Mark Twain National Forest in Missouri. Northeast Missouri University Challenge Cost Share Agreement No. 09-05-94-003. 11 pages.

Hickey, E. 1997. Running buffalo clover survey and monitoring 1997. 3 pages.

Missouri Department of Conservation, 1988. Species Management Plan for the Indiana Bat and Gray Bat in Missouri.

Missouri Department of Conservation and Matthew Winston, July 2001. The Missouri Fish Inventory Database, Columbia, MO

Missouri Department of Conservation. 2003. Wildlife Code of Missouri, MO Department of Conservation. Jefferson City, MO. 174pp.

Missouri Department of Conservation. Missouri Species of Conservation Concern Checklist. Jefferson City, MO. 28pp.

Missouri Department of Natural Resources. March 15, 2000. State of Missouri NonPoint Source Management Plan, Jefferson City, MO

Oesch, R.D. 1984. Missouri Naiades: a guide to the mussels of Missouri. Jefferson City: Conservation Commission of the State of Missouri. 270pp.

Partners in Flight. 2000. Bird Conservation Plan for the Prairie Peninsula (Physiographic Area 31). 52 pages.

Pflieger, W.L. 1997. The Fishes Of Missouri, Revised Edition. Mo Dept. Of Conservation. Jefferson City, Mo. 372 Pp.

Schultes, K.L; Elliot, C. 2002. Roost Tree Selection by Indiana Bats and Northern Bats on the Wayne Forest National Forest, Ohio. In cooperation with the U.S Fish and Wildlife Service. Richmond, Kentucky. 105Pg.

Steyermark, J.L. 1963. Flora of Missouri. Iowa State University Press. Ames, Iowa. 1728 p.

U. S. Federal Register; Volume 67, Number 162. August 21, 2002, pgs. 54261-54306.
<http://www.r6.fws.gov/endspp/shiner/fedreg08212002.htm>

U.S.D.A. Forest Service, Mark Twain National Forest. Ecological Land Classification Aquatic Subsystem.

U.S.D.A. Forest Service, Mark Twain National Forest, Ecological Land Classification Terrestrial Subsystem.

U.S.D.A. Forest Service, Mark Twain national Forest. Fiscal Year 2002 Monitoring and Evaluation Report 44 pp.

U.S.D.A. Forest Service, Mark Twain National Forest, 1986. Wildlife Habitat Evaluation Handbook, Forest Service Handbook 2609.21.

U.S.D.A., Mark Twain National Forest Land & Resource Management Plan. 1986.

U.S.D.A., Forest Service, 1998. Mark Twain National Forest Programmatic Biological Assessment, Eastern Region, Milwaukee, Wisconsin, September 1998.

U.S.D.A Forest Service –Forest Health Protection – Pesticide Management & Coordination 2002. - Several pesticide risk assessments (including Glyphosate).

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Supplemental Information Report, 2000 RFSS List.

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Supplemental Information Report, Salamanders.

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Final_Monitoring_Report_DFC_MIS_TEP_RFSS_OCTOBER_2002. Rolla, MO 65401. 8 pg.

U.S.D.A Mark Twain National Forest Biological Evaluation (BE) program.

U.S.D.I. Fish and Wildlife Service, 1983. Recovery Plan for the Indiana bat. Washington, D.C. 80 pp.

U.S.D.I. Fish and Wildlife Service 1989. Trifolium stoloniferum Recovery Plan. U.S. Fish and Wildlife Service, Twin Cities, MN. 26pp.

U.S.D.I. Fish and Wildlife Service. 1998. Leptodea leptodon (Scaleshell Mussel) Rangewide Status Assessment 1998. U.S. Fish & Wildlife Service, 1 Federal Drive Fort Snelling, Minnesota 55111. 41pp.

U.S.D.I., Fish and Wildlife Service, 1999. Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri, Columbia, Missouri, June 23, 1999.

U.S.D.I., Fish and Wildlife Service Species list 07/31/02

Unpb Missouri Department Of Conservation Heritage Database. P.O. Box 180, Jefferson City, Missouri 65102. 573-751-4115.

Yatskievych, G. 1999. Steyermark'S Flora Of Missouri, Volume I (Revised Edition). Missouri Dept. Of Conservation And Missouri Botanical Garden Press. St Louis, Mo. 991 Pp.

Invasive Plant Management Reference List:

Belsky, A. J. and J. L. Gelbard. 2000. Livestock grazing and weed invasions in the arid west. Scientific Report. Oregon Natural Desert Association. 31 pp. Online at <http://www.onda.org/library/papers/WeedReport.pdf>.

Burns and McDonnell Consulting Firm. January 1997. Environmental Assessment for Union Electric Right-of-Way Vegetation Management in the Mark Twain National Forest, Kansas City, MO.

Dow AgroSciences. 1996. Specimen Label for Garlon 3A, 6 pgs.

Dow AgroSciences. 1997. Specimen Label for Garlon 4, 7 pgs.

<http://www.dowagro.com/range/products/remedy.htm>.

Griffith, D. 1999. "Impacts of noxious weeds on ecologic and economic systems." P. 4-18 in Biology and Management of Noxious Rangeland Weeds, edited by R.L. Sheley and J. K. Petroff. Corvallis, Oregon. Oregon State University. 438 p.

Missouri Department of Conservation. 1997. Missouri Vegetation Management Manual, 161 pgs.

Missouri Revised Statutes. August 28, 2003. Chapter 263, Section 263.205. Insect Pests and Weeds.

The Nature Conservancy. 2002. Element Steward Abstract for Multiflora Rose, Tall Fescue, Sericea Lespedeza, Arlington, Virginia.

Olson, B. E. 1999."Economic evaluation procedures for noxious weed management on rangeland." P. 44-56 in Biology and management of noxious rangeland weeds, edited by R.L. Sheley and J. K. Petroff. Corvallis, Oregon. Oregon State University. 438 p.

Rice, Dwayne R. 2004. Sericea Lespedeza – What? What? How? When? High Plains Journal, Eastern Kansas and Missouri Edition, April 12, 2004, Page 12-B.

SERA (Syracuse Environmental Research Associates). 2003. Glyphosate – Human Health and Ecological Risk Assessment Final Report. SERA TR 02-43-09-04a. March 1, 2003. Syracuse Environmental Research Associates, Inc., Fayetteville, NY.

SERA (Syracuse Environmental Research Associates). 1996. Selected Commercial Formulation of Triclopyr – Garlon 3A and Garlon 4 Risk Assessment Final Report. SERA TR 95-22-02-02a, Syracuse Environmental Research Associates, Inc., Fayetteville, NY. March 31, 1996.

Tu, M., Hurd, C. & J.M. Randall,.2001. Weed Control Methods Handbook, The Nature Conservancy, <http://tncweeds.ucdavis.edu>. Version: April, 2001.

US EPA (Environmental Protection Agency). 1986. Hazard Evaluation Division. Standard Evaluation Procedure, Ecological Risk Assessment. Prepared by Urban and Cook. Office of Pesticide Programs, Washington, DC.

USDA Forest Service, 2003. Invasive Plant Program. 1 page.
http://www.fs.fed.us/foresthealth/briefs/Invasive_Plants

USDA Forest Service, March 2004. Native Plant Framework for the Forest Service Eastern Region.7 pgs.
<http://www.fs.fed.us/foresthealth>.

USDA Forest Service. 1998. Stemming the invasive tide. Forest Service strategy for noxious and nonnative invasive plant management. U.S.D.A. Forest Service. Washington, D.C. 31 pp.

USDA Forest Service. 2001. Guide to Noxious Weed Prevention Practices.
www.fs.fed.us/rangelands/ecology/invasives

USDA, Forest Service. 1992. Risk assessment for herbicide use in Forest Service regions 1, 2, 3, 4 and 10 and on Bonneville Power Administration Sites. FS 53-3187-9-30.

USDA Forest Service. 1989. Draft Environmental Impact Statement Vegetation Management in the Ozark/Ouachita Mountains. Appendices. Volume II.

USDA Forest Service 1990a. Final Environmental Impact Statement Vegetation Management in the Ozark/Ouachita Mountains. Volume 1.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book, Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Washington, D.C. 109 pp.

Electronic Information sources:

The Missouri Department of Conservation maintains the Missouri Fish and Wildlife Information System (MOFWIS) and Heritage database. *Note: The two above sites can be accessed at*
www.conservation.state.mo.us/nathis/.

The Nature Serve database <http://www.natureserve.org/explorer> was accessed on June 30, 2003.

<http://infoventures.com/e-hlth/pesticide/glyphos.html>

<http://infoventures.com/e-hlth/pesticide/triclopy.html>

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Appendix B

Glossaries

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Appendix B - Glossary of Terms Used

A

Activity	Actions, measures, or treatments that are undertaken which directly or indirectly produce, enhance, or maintain forest and rangeland outputs or achieve administrative or environmental quality objectives, such as recreation.
affected environment	The natural and physical environment and the relationship of people to that environment that will or may be changed by actions proposed.
air quality related values (AQRV's)	A feature or property of an area that is (or has the potential to be) affected in some way by air pollution. General categories are: flora, fauna, soil, water cultural/historical resources, odor and visibility.
alternative	In Forest Planning, a mix of practices applied in specific amounts, locations, and periods to achieve future forest conditions through the application of management prescriptions.
ambient air	The air of the surrounding outdoor environment. The air encompassing a specific geographic area.
animal unit (AU).	Defines forage consumption on the basis of one standard mature 1,000-pound cow, either dry or with calf up to 6 months old; all other classes and kinds of animals can be related to this standard, e.g. a bull equals 1.25 AU, a yearling steer equals 0.6 AU.
animal unit month (AUM).	The amount (780 pounds) of air-dry forage calculated to meet one animal unit's requirement for one animal unit for one month.
aquatic	Aquatic pertains to standing and running water in streams, rivers, lakes, and reservoirs.
aspect	The compass direction that the slope of a land surface faces toward.
attainment area	A geographic area in which levels of a criteria air pollutant meets the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant. An area may have on acceptable level for one criteria air pollutant, but may have unacceptable levels for others. Thus, an area could be both attainment and non-attainment at the same time. Attainment areas are defined using federal pollutant limits set by EPA. There are six Criteria Pollutants; Lead (Pb), Sulfur Dioxide (SO _x), Nitrogen Oxides (NO _x), Ozone (O ₃), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO) which are regulated by EPA. A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.
available water holding capacity	The maximum amount of water a soil profile can hold, which can be used by plants.

B

biodiversity	The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.
Biological Assessment (ESA species)	Biological Assessment (ESA species) A "biological evaluation" conducted for major Federal construction projects requiring an environmental impact statement, in accordance with legal requirements under section 7 of the Endangered Species Act (16 U.S.C. 1536(c)). The purpose of the assessment and the resulting document is to determine whether the proposed action is likely to affect an endangered, threatened, or proposed species.
Biological Control	The use of animals, fungi, or other microbes to feed upon, parasitize or otherwise interfere with a targeted pest species.
Biological Evaluation (Forest Service Sensitive Species)	A documented Forest Service review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, proposed, or sensitive species.
Biological Opinion (BO)	An official report by the Fish and Wildlife Service (FWS) issued in response to a formal Forest Service request for consultation or conference. It states whether an action is likely to result in jeopardy to a species or adverse modification of its critical habitat.
buffer zone	A zone of fixed width in which activities are modified to meet specific objectives of an adjoining site.
bunch grass	Grasses of many genera which grow primarily in tufts of clumps rather than forming a sod or

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	mat. Native warm season grasses are often referred to as “bunch grasses”.
C	
canopy	The vegetative cover formed collectively by the crowns of adjacent trees and other woody growth.
capability	The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity.
carrying capacity	The average number of livestock and wildlife that may be sustained on a management unit compatibly with management objectives. It is a function of site characteristics, and management goals and intensity.
cavity trees	Trees exhibiting hollows large enough to provide shelter for wildlife usage.
Class I Area	A geographic area designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each National Park over 6,000 acres and each Wilderness over 5,000 acres in existence as of August 7, 1977. Subsequent additions of land to those Class I areas are also considered Class I.
Class II Area	A geographic area designated for a moderate degree of protection from future degradation of air quality. Moderate increases in new pollution may be permitted in Class II areas. All wildernesses designated after August 7, 1977 or were less than 5,000 acres are automatically Class II areas, as are all other National Forest System lands.
compaction	In soil, the process by which soil particles are rearranged to decrease void space and bring them in closer contact with each other, thereby reducing available water capacity, aeration, and porosity and increasing bulk density.
cool-season plant	A plant that generally makes the major portion of its growth during the late fall, winter, and spring.
cumulative effect (NEPA)	The impact on the environment which results from the incremental impact of the action when added to other past present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
cumulative effect (ESA)	Those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. <i>NOTE: This definition applies only to section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.</i>
D	
dbh	Diameter breast height of a tree measured 4-1/2 feet above ground level.
deferred rotation	A grazing system that provides for a systematic rotation of the deferment among pastures.
direct effects	Effects that are caused by the action and occur at the same time and place.
displacement	In soils, often used interchangeably with erosion. Detachment and movement of soil particles by water, wind, ice, or gravity and can be natural, human caused or both.
dolomite	A limestone or marble rich in magnesium carbonate.
duff	The more or less firm organic layer on top of mineral soil, consisting of fallen vegetative matter in the process of decomposition, including everything from pure humus below to the litter on the surface.
E	
ecological classification system (ECS)	A systematic procedure for delineating, naming, and describing units of land with management significance and ecological integrity. It includes a terrestrial and an aquatic subsystem.
ecological landtype (ELT)	An area of land with a distinct combination of natural, physical, chemical, and biological properties that cause it to respond in a predictable and relatively uniform manner to the

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	application of given management practices. In a relatively undisturbed state and/or at a given stage (sere) of plant succession, an ELT is usually occupied by a predictable and relatively uniform plant community. Typical size generally ranges from about ten to a few hundred acres.
endangered species (E)	Any species which is in danger of extinction throughout all or a significant portion of its range and which has been designated as endangered in the FEDERAL REGISTER under the Endangered Species Act (ESA).
environmental analysis	An analysis of alternative actions and their predictable short and long-term environmental effects which include physical, biological, economic, and social factors. The process associated with the preparation of an environmental assessment or environmental impact statement, environmental assessment (EA) A public document that serves to (1) briefly provide sufficient analysis and evidence for determining whether to prepare an environmental impact statement or a finding of no significant impact and (2) aid in agency's compliance with the NEPA when no environmental impact statement is necessary (40 CFR 1598.9a).
environmental effect	Net change (good or bad) in the physical, biological, social, or economic components of the environment resulting from human actions.
environment impact statement (EIS)	A statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act of 1969 (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality guidelines, and directives of the agency.
even-aged silvicultural system (EAM)	See silvicultural system, even-aged.
F	
fen	A distinctive bog-like wetland in which ground water seepage and small springs saturate soils or substrates and which is dominated by a wide variety of sedges and herbs.
fire ecology	The study of the effects of natural and anthropogenic fire on ecosystems, plants and animals, and its application/role in carrying out resource management objectives.
floodplain	Lowland and relatively flat areas adjoining inland and coastal water including flood-prone areas of off-shore islands, including as a minimum, that area subject to a one percent or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain (one percent chance floodplain). The critical action floodplain is defined as the 500-year floodplain (0.2 percent chance floodplain).
forage	Browse and herbage that are available for food for grazing animals or be harvested for feeding. Forage production. The weight of forage that is produced within a designated period of time on a given area (e.g. pounds per acre).
forbs	Any herbaceous plant other than a grass.
Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA)	An act of Congress requiring the preparation every five years of a program for the management of the National Forests, renewable resources and every 10 years an inventory of all National forest and rangeland resources.
forest	A natural community in which 90 to 100 percent of the landscape is covered in trees, and often contains multiple subcanopy layers, shrubs, ferns, and ephemeral herbs. Forests are found in protected valleys, ravines, bluff bases, lower north-facing slopes, and fire shadow areas.
Forest Plan	A shortened name for Land and Resource Management Plan.
Forest Service Handbook (FSH)	Handbooks are directives that provide detailed instructions on how to proceed with a specialized phase of a program or activity. Handbooks are usually based on a part of the manual or incorporate external directives.
Forest Service Manual (FSM)	The manual contains legal authorities, objectives, policies, responsibilities, delegations, and instructions needed on a continuing basis by Forest Service line officers and primary staff in more than one unit to plan and execute assigned programs and activities.
forest type	A descriptive term used to group stands of similar character or development and species

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	composition by which they may be differentiated from other groups of stands.
fragipan	Loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt and fine sand. A fragipan appears cemented and restricts roots. When dry, it is very hard and has a higher bulk density than the horizons above. When wet, it tends to rupture suddenly under pressure rather than to deform slowly.
fuels	Wildland vegetative materials that can burn. While usually referring to above ground living and dead wildland surface vegetation, roots and organic soils such as peat are often included.
G	
game species	Any species of wildlife or fish for which seasons and bag limits have been prescribed under state or federal laws, codes, and regulations.
glade:	A predominantly rocky, shallow-soil barren area dominated by an herbaceous layer of grasses, sedges, and herbs and with sparse woody vegetation. Eastern red cedar often invades many glades as a result of past or current overgrazing and fire suppression.
grass	A plant with long, narrow leaves having parallel veins and nondescript flowers. Stems are hollow or pithy in cross-section.
Grazing management	The control of grazing and browsing animals to accomplish a desired result.
Grazing system	Grazing management that defines the periods of grazing and non-grazing.
H	
habitat	The place where animals live. It can be water for beaver, fish, and aquatic insects; caves for bats; or forested areas for many mammals, birds, and reptiles.
hardwood	A broad-leaved flowering tree that drops its leaves annually, as distinguished from a conifer.
herbicide	A chemical from a group of chemicals known as pesticides, which prevent, destroy, repel or mitigate any pest. A herbicide is a chemical substance used to specifically kill undesirable plants.
Heritage Resource	The physical remains (artifacts, ruins, burial mounds, petroglyphs, etc.) or conceptual context (as a setting for historic, or prehistoric events, etc.) of an area that gives insight into the lives of earlier man.
I	
implementation	Forest Plan implementation is the action necessary to ensure uniform accomplishment of the Forest and Regional management direction. 36 CFR 219.10(e).
indirect effects	Those effects that are caused by or will result from the proposed action and later in time, but are still reasonably certain to occur.
Interdisciplinary Team (IDT)	A group representing several disciplines used for regional and forest planning to insure coordinated planning of the various resources. Through interactions among its members, knowledge of the physical, biological, economic and social sciences, and the environmental design arts shall be integrated in the planning process.
Intermittent stream	A stream or portion of a stream, which in general, flows during wet seasons and are dry during dry seasons. The groundwater table lies above the bed of the stream during the wet season but drops below the streambed during dry seasons. Hence, the flow is derived principally from surface runoff, but during wet seasons receives a contribution from groundwater.
Invasive plant	Plants that have been introduced into an environment in which they did not evolve and usually do not have natural enemies to limit their reproduction or spread. Invasive plants have characteristics that permit them to rapidly invade and dominate new areas, out-competing other vegetation for light, moisture and nutrients.
K	
karst	Terrain with distinctive characteristics of relief and drainage arising primarily from a higher degree of rock solubility in natural waters than is found elsewhere. Some of these characteristics are dry streams, underground drainage, eaves, and sinks.
L	
Land and Resource Management Plan (Forest)	A plan of management for a National Forest developed in accord with the principles set out in 36 CFR 219.1 and the planning process set out in 36 CFR 219.12 and which will provide for

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Plan)	multiple use and sustained yield of goods and services in a way that maximizes long-term net public benefits in an environmentally sound manner.
landtype association (LTA)	These are recurring areas of land approximately 5,000 to 100,000 acres, fairly uniform in land surface form, subsurface geological materials, patterns of soils, and potential natural vegetation. Each LTA exhibits a unique pattern of ecological landtypes (ELTs). It is a subdivision of a physiographic subsection.
legume	An herb, shrub, or tree of the family Leguminous bearing nodules on the roots that contains nitrogen-fixing bacteria.
Loess	Material transported and deposited by wind and consisting of predominantly silt sized particles.
M	
management area (MA)	An area that has direction to achieve a common goal throughout. The entire Forest is divided into management areas; each is given a description, and the policies and management prescriptions relating to their use are listed with them.
management indicator species (MIS)	A species whose presence in a certain location or situation at a given population indicates a particular environmental condition. Their 'population changes are believed to indicate effects of management practices on a number of other species or water quality.
management prescription (MP)	Management practices and intensities selected and scheduled for application on a specific area to attain multiple use and other goals and objectives. 36 CFR 219.3.
mesic:	A soil moisture class (moisture modifier) used to describe relative soil moisture availability. Soil that is moderately well drained; water is removed from the soil somewhat slowly, so that the soil profile is wet for a small but significant part of the time. Mesic soils are productive with high site productivity indices, but often rare in the Ozarks in being restricted to north and east-facing slopes and large floodplains.
monitoring and evaluation	The periodic evaluation, on a sample basis, of management practices to determine how well Forest Plan objectives have been met and how closely management standards have been applied.
multiple use	The management of all the various natural resources of the National Forest so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration given to the relative values of the various resources, and not necessarily the combination of the uses that will give the greatest dollar return or the greatest unit output.
N	
National Ambient Air Quality Standards (NAAQS)	Legal limits of atmospheric pollution established by the Environmental Protection Agency (EPA), as the concentration limits needed to protect all of the public against adverse effects on public health and welfare, with an adequate safety margin. Primary standards are those related to health effects; secondary standards are designed to protect the public welfare from effects such as visibility reduction, soiling, material damage and nuisances. There are six criteria pollutants; Lead (Pb), Sulfur Dioxide (SO _x), Nitrogen Oxides (NO _x), Ozone (O ₃), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO). A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.
National Environmental Policy Act of 1969 (NEPA)	An act to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality.
National Forest	

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Management Act of 1976 (NFMA)	A law passed as an amendment to the Forest and Rangeland Renewable Resources Planning Act and which requires the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.
National Forest System land (NFS)	National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.
National Register of Historic Places	A listing maintained by the U.S.D.I. National Park Service of areas which have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation as a whole.
native grasses	Grasses that originated in the area in which they are found, i.e., were not introduced and naturally occur in that area.
natural regeneration	The reestablishment of a tree cover by natural seed fall, sprouting, or suckering of vegetation on or adjacent to the area.
non-attainment area	A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards. A single geographic area may have acceptable levels of one criteria air pollutant but unacceptable levels of one or more other criteria air pollutants; thus, an area can be both attainment and non-attainment at the same time. It has been estimated that 60% of Americans live in non-attainment areas. The six Criteria Pollutants are; Lead (Pb), Sulfur Dioxide (SO ₂), Nitrogen Oxides (NO _x), Ozone (O ₃), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO). A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.
Noxious weed	Plants that interfere with agriculture, cause human health problems or invade and degrade the environment.
O	
off-road vehicle (ORV-OHV-ATV)	Any motorized vehicle designed for or capable of cross-country travel on or over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (a) any registered motorboat, (b) any fire, military, emergency, or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (c) any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract.
open land management	Application of management activities with the intent of maintaining or converting grass and/or herbaceous vegetation regardless of the historic natural vegetation occurring on the site. For example: using prescribed fire or mechanical methods to prevent exotic species or honey locust from invading a fescue pasture with the intent to plant native warm season grasses for wildlife purposes.
over-story	That portion of the trees in a forest forming the uppermost canopy.
overuse	Using an excessive amount of the current years growth.
P	
Partial Retention (PR)	A visual quality objective that in general means man's activities may be evident but must remain subordinate to the characteristic landscape.
pasture	A grazing area enclosed and separated from other areas by fencing or other barriers.
PM-10	Particles with an aerodynamic diameter smaller than ten micrometers. Particles this size and smaller have been shown to cause problems with human health and visibility.
PM-2.5	Particles with an aerodynamic diameter of 2.5 micrometers. Particles this size and smaller have been shown to cause problems with human health and visibility.
prescribed burning	Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.
prescribed fire	A management ignited wildland fire that burns under specified conditions, where the fire is confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives

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project	A project is a combination of one or more management practices and associated support activities to meet the intent of the Forest Plan.
Project Area	Similar features in combination that reflects the basic land characteristics and existing conditions. These features are combined for the purpose of analysis in formulating alternatives and monitoring results.
Proposed species	Any species of fish, wildlife, or plant that is proposed in the FEDERAL REGISTER to be listed under section 4 of the Endangered Species Act.
puddling	Act of destroying soil structure, reducing porosity and permeability. Often results from handling soil when it is in a wet, plastic condition so that when it dries it becomes hard and cloddy.
R	
range improvement	Any practice designed to improve range condition or allow more efficient use.
range management	A distinct discipline founded on ecological principles with the objective of sustainable use of rangelands and related resources for various purposes.
Range Management Unit (RMU) (Allotment).	Any management area with range management objectives such as grazing allotments.
Ranger District	Administrative subdivision of a National Forest supervised by a District Ranger who reports to a Forest Supervisor.
reforestation	All treatments and activities aiding the re-establishment of a tree crop or tree cover on forested land. It includes the preparation of the ground surface prior to natural seed fall, natural sprouting, artificial seeding, or planting. It also includes the setting out of seedlings, cuttings, or transplants, and scattering or placement of seed over a designated area for the re-establishment of a forest stand.
riparian area	A term used by the Forest Service that includes stream channels, lakes, adjacent riparian ecosystem, floodplain, and wetlands.
Risk assessment	Assessment of risk to human health and ecosystem from herbicide use.
road density	The measure of the degree to which a length of road occupies a given land area: e.g., one mile of road within a square mile.
rutting	Soil disturbance where the soil is puddled and the topsoil and/or a portion of the subsoil removed.
S	
salvage	The utilization of trees that are dead, dying, or deteriorating before they become worthless.
SASEM	Simple Approach Smoke Emissions Model. According to the Huntana Web site, SASEM is a screening 1 planning level, Gaussian dispersion model designed to predict ground level particulate matter and visibility impacts from single sources in relative flat terrain in the western United States. SASEM utilizes internally calculated plume rise and emission rates based on specified fuel types and configurations. The model is limited to particulate matter and visibility impact assessments; simplicity requires several physical assumptions. According to Miller, the Simple Approach Smoke Estimation Model (SASEM) is a tool for the analysis of smoke dispersion from prescribed fires (Sestak and Riebau 1988). It is a screening model, in that it uses simplified assumptions and tends to over predict impacts, yielding conservative results. If violations of air quality standards are not predicted by SASEM, it is unlikely that they will occur. Inputs to the model include basic descriptions of the fuels, such as type and loading, expected fire line intensity, and expected burn duration. Wind speed and direction, dispersion conditions, and average mixing height are considered, as well as distance and direction of the fire from sensitive receptors. The model calculates fuel consumption and particulate emission factors from fuel loading and expected fire line intensity. Model outputs include maximum particulate concentration and the distance from the fire at which it will occur, ranges of distances from the fire at which any primary or secondary particulate standards would be violated, and the reduction in visual range at selected receptors. Outputs are given in tabular fashion for a range of dispersion and wind speed conditions.
savanna	A prairie-like natural community in which 10 to 30% is covered in trees characterized by wide

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	crowns and spreading limbs, generally associated with level to gently rolling topography. Dominant trees include bur, chinquapin, post, and white oaks.
sensitive species (RFSS)	<p>Species designated by the Regional Forester and included on the Eastern Region Sensitive Species list. The list will include those species identified by criteria below that are known, reported, or suspected to occur on or in the immediate vicinity of the planning area in the Eastern Region. The criteria are:</p> <ul style="list-style-type: none"> A. Species is in officially proposed status by Federal Register Proposed Rule making. B. Species is on a Notice of Review List in the Federal Register (e.g., CFR 45: 242; 12/15/80). C. Species placed on the Region 9 Sensitive Plant or Animal lists at the discretion of the Regional Forester if he deems that they require special management attention. <p>Examples of situations that may cause such listing include:</p> <ul style="list-style-type: none"> 1. Species common elsewhere, but a disjunct population of unique, popular, or scientific interest occurs on National Forest System land. 2. Locally endemic population in unique habitats that warrant continued monitoring or special management to assure jeopardy is not occurring and will not occur in the future.
Serecia lespedeza	An introduced perennial legume with erect, somewhat woody stems that is a native of eastern Asia. Invasive weed species.
silviculture	The science and art of cultivating forest tree crops. The theory and practice of controlling the establishment, composition, constitution, and growth of forests.
Silvicultural System	<p>A planned process whereby a stand is tended, harvested, and re-established. The system name is based on the number of age classes and/or the regeneration method used.</p> <p>Even-Aged Methods: Methods to regenerate a stand with a single age class.</p> <p>clearcutting: A method of regenerating an even-aged stand in which a new age class develops in a fully-exposed microclimate after removal, in a single cutting, of all trees in the previous stand. Regeneration is from natural seeding, direct seeding, planted seedlings, and/or advance reproduction.</p> <p>seed tree: An even-aged regeneration method in which a new age class develops from seeds that germinate in fully-exposed micro-environments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established.</p> <p>shelterwood: A method of regenerating an even-aged stand in which a new age class develops beneath the moderated micro-environment provided by the residual trees. The sequence of treatments can include three distinct types of cuttings: 1) an optional preparatory cut to enhance conditions for seed production; 2) an establishment cut to prepare the seed bed and to create a new age class; and 3) a removal cut to release established regeneration from competition with the overwood.</p> <p>Uneven-Aged (Selection) Methods: Methods of regenerating a forest stand, and maintaining an uneven-aged structure, by removing some trees in all size classes either singly, in small groups, or in strips.</p> <p>group selection : A method of regenerating uneven-aged stands in which trees are removed, and new age classes are established, in small groups. The maximum width of groups is approximately twice the height of the mature trees, with small openings providing micro-environments suitable for tolerant regeneration and the larger openings providing conditions suitable for more intolerant regeneration</p> <p>single tree selection: A method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed more-or-less uniformly throughout the stand to achieve desired stand structural characteristics.</p>
sinkhole	A depression on the land surface of various depths, sizes, and shapes resulting from the

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	collapse of surface or near-surface material into underlying cavities. Surface water or precipitation drainage is funneled toward the basin of the sinkhole where it either enters a subsurface cavity or is trapped and forms a pond or wetland.
skid trail	A path traversed by a tractor or skidder one or more times in which mineral soil is not intentionally exposed. Machines operate on the litter surface and not on a graded surface.
slash	The vegetative residue left on the ground after felling and other silvicultural operations or accumulating there as a result of storm, fire, girdling, or poisoning.
snags	Dead trees with or without cavities, at least 6 inches in diameter and at least 10 feet in height.
Soil displacement	The movement of soil particles from one place to another by erosion or management activities and/or those influences which result in the soil structure.
Soil horizons	<p>A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil forming processes and differing in characteristics and properties from the adjacent layers above and below it.</p> <p>O horizon – Organic layer of fresh and decaying plant residue</p> <p>A horizon – The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with mineral material. This horizon has the most organic matter accumulation, the most biological activity, and/or loss of soil materials containing iron, aluminum, and clay.</p> <p>B horizon – Horizon, usually below the O, A, or E horizon, and is, in part, a transition layer from the overlying horizon to the underlying C horizon. It is characterized by (1) accumulation of clay material, humus, and other material, (2) granular, prismatic, or blocky structure, and/or (3) redder or browner colors than those in the overlying horizon.</p> <p>C horizon – Mineral horizon, excluding bedrock, that is little affected by soil forming processes and does not have properties found in the overlying horizon.</p> <p>E horizon – Mineral horizon in which the main feature is loss of clay particles, iron, aluminum, or combination of these.</p> <p>R horizon – Bedrock underlying the C horizon.</p>
special use permit	Permits, memorandums of understanding, and easements (excluding road permits and highway easements) authorizing the occupancy and use of National Forest land for a specific period of time by individuals, organizations, or businesses generally for a fee.
stand	A community of trees or other vegetation possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement, or condition, to be distinguishable from adjacent communities, so forming a silvicultural or management entity.
standards and guidelines (S&Gs)	Criterion indicating acceptable norms, specifications, or quality that management actions must meet.
subsoil	Technically, the B horizon.
subsurface layer	Any surface soil horizon below the surface layer
surface soil	The A, E, or combinations of those horizons.
T	
temporary road	Temporary roads are roads without formal design and survey used to provide access to the Forest for resource management purposes and are subsequently closed after these resource objectives have been met. The land occupied by the road is reclaimed for natural resource purposes.
terrestrial	Land related.
Terrestrial Natural	An interrelated assemblage of plants and animals found in a given area delineated by soil

Appendix B - Glossary of Terms Used

Community:	moisture modifier, substrate type, and vegetation structure. Example: Dry chert woodland (Nelson, 1987).
threatened species (T)	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and which has been designated in the Federal Register under the Endangered Species Act.
timber production	The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use.
U	
understory	The trees and other woody species growing under a cover of foliage formed collectively by the upper portion of adjacent trees and other woody growth.
V	
viable population	A population, which has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population on the planning area.
visual quality objective (VQO)	A desired level of excellence based on physical and sociological characteristics of an area. It refers to degree of acceptable alteration of the characteristic landscape.
W	
warm-season plant	A plant that makes most or all its growth during late spring, summer or early fall and is usually dormant in winter.
weed	(1) A plant growing where unwanted. (2) A plant having a negative value within a given management system.
wildfire	A fire occurring on wildland that is not meeting management objectives and thus requires a suppression response.
woodland:	A natural community in which 30 to 90 percent of the landscape is covered in trees and often containing a dense woodland grass/sedge/and herb ground layer resulting from frequent fires. The understory is sparse to dense depending on fire frequency. This natural community is often found on steep upper slopes with southerly aspects, narrow ridges, broad ridges, and fire prone landscapes.
X	
Xeric:	Describing sites without significant moisture, very dry sites.

Glossary of Abbreviations and Acronyms

ATV	All terrain vehicle
AUM	Animal Unit Month
BA	Biological Assessment
BE	Biological Evaluation
BMP	Best Management Practice
BO	Biological Opinion
CDS	Combined Data System
CEQ	Council on Environmental Quality
DFC	Desired Future Condition
EIS	Environmental Impact Statement
ELT	Ecological Landtype
ESA	The Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement

Glossary of Abbreviations and Acronyms	
FR	Forest Service Road
FWS	United States Fish and Wildlife Service. See also USFWS.
GIS	Geographic Information System
ID	Interdisciplinary Team
Kg	Kilogram (1000 grams)
LC₅₀	Median Lethal Concentration
LD₅₀	Median Lethal Dose
LRMP	The Mark Twain National Forest's Land and Resource Management Plan
LTA	Landtype Association
Mg	Milligram (1/1000 of a gram)
MA	Management Area
MBF	Thousand Board Feet
MDC	Missouri Department of Conservation
MIS	Management Indicator Species
MOS	Margin of Safety
NOEL	No Observed Effect Level
MOFWIS	Missouri Fish and Wildlife Information System
MP	Management Prescription
MSDS	Material Safety Data Sheet
MTNF	Mark Twain National Forest
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act of 1976
NFS or NFSL	National Forest System Land
NRCS	Natural Resource Conservation Service
NTMB	Neotropical Migrant Bird
NWI	National Wetlands Inventory
OOHA	Ozark-Ouachita Highlands Assessment
PIF	Partners in Flight
PPE	Personal Protective Equipment
ppm	Parts per million
RfD	Reference Dose
RFSS	Regional Forester's Sensitive Species
ROS	Recreation Opportunity Spectrum
RPA	Forest and Rangeland Renewable Resources Planning Act of 1974
SCS	Soil Conservation Service
SOPA	Schedule of Proposed Actions
T&E	Federally listed as threatened or endangered
TES	Includes Threatened, Endangered, Proposed and Sensitive Species
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
WFRP	Wildlife, Fish, Rare Plants Monitoring Report
WRD	The United States Geological Survey's Water Resources Division

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APPENDIX C

Biological Diversity

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Appendix C - Biodiversity

The Council on Environmental Quality in January 1993 published "Incorporating Biodiversity Considerations Into Environmental Impact Project Under the National Environmental Policy Act". This report outlined several General Principles that are intended to help managers and planners identify biodiversity concerns and seek solutions in specific situations as agencies pursue their diverse mandates (CEQ General Principles Pages 6-8). The principles and how they relate to the Middle River Project Area are:

1. Take a "big picture" or ecosystem view.

The Middle River project area is located at the very Northern edge of the Oak Hickory-Hills Land Type Association (LTA) in the Outer Ozark Border Subsection, Ozark Highlands Section, Eastern Broadleaf Forest (Continental) Province, Hot Continental Division, and Humid Temperate Domain. It is located near the southern boundary of the Oak-Bluestem Plains LTA. The LTA information is from the Mark Twain Forest Plan and the section, province, division and domain come from the (Ecoregions & Sub regions of the United States, USDA, 1994)

The Cedar Creek Unit is the only portion of the Mark Twain National Forest that is located North of the Missouri River. The remainder of the Mark Twain National Forest is scattered throughout the Southern part of Missouri in the Ozark Highlands.

The project area contains gently rolling landscape that has potential natural vegetation of oak-hickory forest interfaced with bluestem prairie. The oak-hickory forest is generally older and intermixed with cool season and native grasses. Historic and natural disturbance factors include infrequent low intensity fires, windstorms and tornadoes, insect/disease mortality, occasional summer drought or late spring frost, ice storms, and cattle grazing.

Prehistoric and Historic Ecological Changes

Wildfire is among the oldest of natural phenomena. Wildfires, whether lightning caused or set by humans, trace their ancestry to the early development of terrestrial vegetation. Hardly any plant community in the temperate zone has escaped fire's selective action. Many biota have consequently so adapted themselves to fire that such adaptations have become symbiotic (Pyne, 1982). Missouri is no exception. Natural and man-made fires were and are clearly evident across the landscape. Trees bear fire scars dating back hundreds of years. Early explorers wrote about the numerous fires set by Indians. Even today's remaining natural vegetation and wildlife alludes to the importance of fire. From an ecological and natural resource management perspective fire is treated as one of many factors in the environment comparing with rainfall, tornados, and drought. The effects can be both beneficial and destructive.

There is evidence that Paleo Indians, nomadic hunters and gatherers people used the general area prior to 8000 BC. The Mississippian people used the land for agricultural purposes between A.D. 900 and 1700. These were the predecessors of the Osage, Iowa, Kickapoo, Pottawatomie, Sioux, Sac, and Fox Indians, whom the European Explorers contacted after 1700. Native Americans have constantly influenced plant communities and ecosystems throughout North America and the Ozark Highlands for thousands of years

especially through widespread broadcasting of fire that burned across the land. American Indians regularly set fires that burned across huge areas and stopped only at rivers or when rain intervened. Lightning fires were added ignition sources, such fires have resulted in the occurrences of fire dependent prairies, savannas, and woodlands.

European settlers began making dramatic changes to the land commencing in the 1830's through land clearing and the suppression of fire. Prior to European settlers it is estimated that the fire frequency on lands comprising the Cedar Creek Unit was once every 3 – 25 years (Rich Guyette Personnel communication 2003). The fire frequency was reduced after settlement and it was reduced even more when modern fire suppression tactics were implemented during the mid 20 th century. The settlers also had an impact on plants and animals by reducing certain habitats by farming (which converted some prairie into fields) and fencing areas. The over-hunting of some species was also a concern. The loss of large free roaming ungulates such as Bison also had an effect.

Status and Trends of Vegetation

The original land survey of Callaway County was conducted in 1816-1817. Following this, the U.S. Government offered the land for sale and thus initiated the major immigration into the county. Areas settled first included the bottomland and the wooded areas near the major rivers and streams. The grassland in the northern part of the county was foreign and appeared barren to the settlers, who had been raised in wooded New England or the South. Therefore the prairie was often the last area settled. Traditional uses include small farming or cattle raising; hunting, fishing and trapping; and removal of various kinds of wood products. More recently uses include recreational hiking and camping. Most of the original forest cover was cut over by the early 1900's. Extensive overgrazing, intensive cultivation and annual burning caused severe depletion and erosion of the fragile soils of the Middle River and other areas. Most of the forested bottomlands were cleared for production of row crops.

Land acquisition records indicate that many of the rough upland areas were settled between the 1880's and the 1930's.

Starting in the early 1940's, the U. S. Soil Conservation Service (now know as the Natural Resource Conservation Service) purchased the land and began rebuilding it by filling and stabilizing gulleys, reseeding grasses and planting trees. In 1953, these public lands were transferred to the Forest Service for administration and management. Protection from annual burning, open range grazing, and indiscriminate logging resulted in re-growth (in non permanent openings) of the oak-hickory forest communities.

Silvicultural Practices

The hardwood forests in the Middle River project area consist primarily of relatively shade-intolerant oaks and hickories. The Cedar Creek Unit has employed both singletree selection and a combination of singletree with group selection (also known as uneven age management) to release shade-intolerant oak regeneration with group openings wherever possible. It has been utilizing uneven age management exclusively since the mid 1980's.

The Cedar Creek Unit has used prescribed burning as a tool for managing areas, burning a yearly average of nearly 500 acres over the last decade. This includes openings and of Forested areas. Overall the the

Mark Twain National Forest has recently been utilizing prescribed fire on approximately 10,000+ acres annually to restore and maintain oak-hickory woodlands, maintain prairies and other open lands, savannas, glades; to sustain wildlife habitat diversity; encourage natural regeneration; and to reduce fuels.

Biological Threats to Forest Resources

Knapweeds, invasive non-native plants, have been present for several decades on some roadsides in southern Missouri. There are health concerns for humans and livestock related to this plant.

Sericea lespedeza, Multiflora Rose and Eastern Red Cedar are the major invasive species to woodlands and openings in Missouri and appear to be rapidly spreading on certain areas of the Cedar Creek Unit and the Mark Twain National Forest. Sericea lespedeza is present along roadsides and old pastures in the Project Area. Multi-flora rose is another non-native invasive noxious weed common in the Middle River area. Red Cedar is usually found in openings and/or old fields.

The Project Area is composed of oak-hickory forest in various successional stages. Historic and natural disturbance factors include fairly frequent low intensity fires, with infrequent high intensity (or stand replacement) fires; windstorms and tornadoes; insect/disease mortality; occasional summer drought or late spring frost; ice storms; and flash flooding in intermittent drainages and permanent streams.

Summary:

In Alternative 1, several things would remain the same: The highways, county roads and Forest Service roads would continue to exist. Grazing would continue on private and federal lands. Natural disturbances, such as windstorm, ice storms, frosts, and insects/disease outbreaks would continue to affect the Project Area. Fire protection would continue because it is a policy of the Forest Service to protect resources from wildland fire, and the proximity of private lands & dwellings makes it imperative. The local economy would continue to rely cattle grazing on federal lands as well as a limited amount of wood products. Both of these would come from private lands as well as other public lands. Hunting, fishing, trapping and other recreational pursuits would continue.

Alternative 2 and 3 would utilize practices such as mowing and/or grazing during the appropriate time of the year to help minimize the spread of the existing Non-native and Noxious weeds in the area. Both of these alternatives include limited, site specific herbicide use to control non-native and noxious weeds in the area.

Alternative 2 is intended to use traditional kinds of disturbances such as fire. Logging in an environmentally sensitive way would be used to manage areas and to create and maintain natural communities in all their successional stages. Out of this would come sustainable plant and animal communities as well as sustainable supplies of goods and services.

Alternative 3 would continue to use traditional types of disturbance such as fire, that could result in sustainable plant and animal communities. However, if the fire is not intense, it may not create early successional habitat in permanently forested areas.

2. Protect communities and ecosystems.

The Upper and Lower Ozarks sections of the Ozarks Natural Division have been continuously available for habitation by and evolution of plants, animals and communities since the end of the Paleozoic era (200 million years ago). The great geologic age and hypsographic diversity make the Ozarks by far the most biologically diverse area in the state of Missouri and one of the most significant centers of biodiversity in North America. A large percent of biodiversity is found in smaller/rarer communities such as caves, springs, sinkholes, glades, etc. This diversity of habitats, species endemism, and occurrence of relic plant and animal populations are inextricably linked to Missouri's past climatic changes, prehistoric vegetation history, and geology.

The oak-hickory forest with all its successional stages is a major community in the Project Area. There are subtle differences in vegetation depending on Ecological Land Type (slope & aspect). For instance, broad ridges & southwest slopes are warmer & drier and support more white oak. North slopes are moister and are suitable for a slightly different assemblage of herbaceous plants along with a higher component of hardwood trees. However there are a large amount of openings in the Middle River area. In the non prairie areas, Oak can be considered a species, which has a central role on which the integrity of the whole ecosystem relies. The oak species provides important food, habitat and other ecological values which encompass a wide variety of plants, insects, animals and even small, inconspicuous species such as mycorrhiza-forming fungi (such as honey mushrooms, chanterelles, and boletes).

Oak forests are changing ecologically because of widespread successional replacement of oaks by more shade tolerant species, such as sugar maple, the absence of fire, and oak dieback and decline.

White oak species predominate, with red oak intermixed but already dying out in many stands. Cedar is a prevalent component, particularly in old field settings. The shade tolerant sugar maple has been accumulating in the under story in many stands. In drainages adjacent to permanent water, bottomland hardwood species such as sycamore, river birch, cottonwood and ash are present.

The 3.4 management prescription "emphasizes wildlife habitat diversity to maintain and enhance populations of native and naturalized vertebrates." (FP IV-115). Ecological Land Types present in the project area include: upland forest, side slopes (ELT 51,52,53,55), Upland mesic forest (ELT 56), loess-derived upland forests (ELT 54), and dry rocky upland forest (ELT 57).

Summary:

Alternative 1 would mean that only natural disturbances (with the exception of fire suppression and livestock grazing) would occur. All communities present would continue to exist, although the amount of each community type might fluctuate over time. Fire protection would attempt to keep wildland fires to a minimum. The oak-hickory communities would continue to grow and mature (however, no old growth would be designated) with many small openings created by natural mortality of individual trees and some larger openings created by windstorm, ice damage, insect/disease, or other disturbance. A percent of the area would eventually be in mature and old growth successional stages with a small amount of early successional stages present. The grazed areas would continue to remain open. Open areas that are not grazed would become vegetated as a result of succession. This would involve the encroachment of cedars in many areas.

Alternative 2 and 3 would designate additional old growth, ensuring late successional communities would be available into the future. They would utilize practices such as mowing during the appropriate time of

the year to help minimize the spread of the existing Non-native and Noxious weeds in the area. Both of these alternatives include limited, site-specific herbicide. This is to control, Non-native and Noxious weeds in the area and to enhance hardwood seedling survival.

Alternative 2 is intended to use traditional kinds of disturbances such as fire. Logging in an environmentally sensitive way would be used to manage areas and to create and maintain natural communities in all their successional stages. Out of this would come sustainable plant and animal communities. Uneven age harvest would create small openings similar to those caused by natural tree mortality. These acres would have some value for early successional species, while at the same time maintaining a largely unbroken canopy of forest preferred by mid-successional species. Early successional openings of 0.5 - 2 acres would be created through group selection.

Alternative 3 would continue to use traditional types of disturbance such as fire. Out of this would come sustainable plant and animal communities.

3. Minimize fragmentation. Promote the natural pattern and connectivity of habitats.

The existing canopy closure probably varied from moderate to heavy depending on the soil type, weather conditions, and other disturbance factors. There were probably open woods on most ridge tops and south and west-facing slopes, more dense woods on north and east-facing slopes, and bottomland hardwoods in the riparian corridors. The forest probably had a naturally occurring variety of age classes, sizes and species distribution.

The pattern created by natural disturbances (such as tornadoes, fires, insects and disease etc.) is probably a combination of a large number of small openings created by death of individual trees or small groups of trees, scattered natural openings where soil is poor, and a few large openings in the canopy created by windstorm or wildland fire.

The Middle River and the surrounding area has already has been greatly influenced by man and was already heavily fragmented before being added to the National Forest Service system. The majority of the private land in the area is in permanent openings (fescue pastures) with intermingled small woodlands, farms and housing. See Section 1, 2 and 5 for additional information.

The Cedar Creek Unit consists of 16, 310 acres of Forest Service system lands in Boone and Calloway counties Missouri. The total acres in these two counties is 978,600. According to the 2000 Census Callaway County has a total population of 41, 590 people (a 24% increase from 1990) and Boone County has a population of 136, 774 people (a 20% increase since 1990). The average population density in these counties is 117 people per square mile. Some of the larger population centers nearby include Fulton, Missouri (8 miles and 12,128 people); Columbia Missouri (30 miles and 84,531 people); Jefferson City Missouri (15 miles and 39,611 people) and St. Louis County with over 1 million people is approximately 100 miles away. US Highway 54, a 4 lane divided Highway lies within 2 miles of the Middle River project area.

Summary:

Items common to all alternatives: Private land uses are likely to remain much the same as in the past 10

years (homes, outbuildings, pastures, hayfields, small woodlots). It is also possible that additional woodland would be cut and/or bulldozed to create permanent pasture. Woodlands may continue to be cleared or open areas may be converted into homesites and/or lawns. There would be no fragmentation of forestland in all Alternatives by non-forest land uses; only natural fragmentation of forest types or communities. The differing age-classes and successional stages would leave the forest matrix intact and would continue to provide the mosaic of age-classes and successional stages common in the area for the past 20-30 years.

Alternative 1 - See discussion in #2 above.

The existing permanent openings consist of old open fields. No new permanent openings would be created with this alternative. Alternative 1 designates no old growth.

In Alternatives 2 and 3, a total of 75 existing acres of open lands would be allowed to slowly revert to forested areas by not allowing any management activities such as grazing, mowing and/or burning to occur. Some of these acres would be planted with native hardwoods.

The old growth designations in Alternatives 2 and 3 were selected, as much as possible, to create blocks of continuous old growth habitat, and provide travel ways along drainages.

In alternative 2 temporary openings of several sizes would be created through commercial timber harvest. Many small openings (0-.5 – 2.0 acres) would be created through single tree and group selections (uneven aged management). All these openings would consist of regenerating oak, hickory, and associated trees; small fruiting trees such as dogwood; shrubs and vines such as blackberry and greenbrier; and annual & perennial forbs and grasses. As the regenerating trees grow, the lower vegetation would slowly be shaded out and eventually the opening would cease to exist. These temporary openings reduce the amount of continuous forest canopy (but are still part of the forest community) and provide early successional habitat for a short period (up to 10 years).

Temporary edges would be created where uneven-aged harvest adjoins mature forest. These temporary edges would be young forest against immature or mature forest and would last for about 10-20 years (or until the new regenerating stand grows tall enough to function as immature forest). There would be no new permanent edges created.

Prescribed fire proposed in Alternatives 2 and 3 would help to maintain semi-open areas (increasing the amount of grasses and forbs on the forest floor) and reduce fuel loading.

4. Promote native species. Avoid introducing non-native species.

Natural vegetative communities are described on pages IV - 14 through IV - 17 of the Forest Plan. Communities and management areas, which exist within the Project Area, are described in #1 and #2 above. Perpetuation of a healthy and diverse oak-hickory forest community is one of the primary goals for this Project Area.

Summary:

Items common to all alternatives:

There would be no intentional introduction of non-native species in any Alternative. In addition, there would be no management of native species on inappropriate sites in any of the Alternatives. All Alternative would utilize practices such as mowing and/or grazing during the appropriate time of the year to help minimize the spread of the existing Non-native and Noxious weeds in the area.

Alternative 1 would not utilize any herbicides to control any existing Non-native and Noxious weeds in the area.

The oak-hickory communities and their successional stages would be maintained in Alternative 2. However, native annual and perennial plants would also be found in those areas

Alternative 2 and 3 include limited, site specific herbicide application to control the existing Non-native and Noxious weeds in the area.

5. Protect rare & ecologically important species.

A Biological Assessment (BA) was prepared for the Federally Listed Threatened, Endangered and Proposed Species. A Biological Evaluation (BE) was prepared for the Regional Forester Sensitive Species. The BA and BE for the Middle River project are located in Appendix C. The BA concluded that there was unlikely to be any adverse effects on any listed species as a result implementing Alternative 2. The BE concluded that there was unlikely to be any adverse effects on any sensitive species as a result of any of the alternatives. The BA also determined that Alternative 2, complies with the Reasonable and Prudent Measures and Terms and Conditions of the June 23, 1999 US Fish & Wildlife Service's Biological Opinion.

In March 2001, the MTNF completed a Supplemental Information Report (SIR) regarding information on plethodontid (lungless salamanders). The report was revised in May 2001. The report was made in response to public concern about recent articles describing the decline of these species and effects of silvicultural treatments on salamander populations. The SIR concludes that the 1986 Forest Plan addressed habitat needs for these species and acknowledged the importance of mature/over-mature forest with dead, downed, and rotten woody debris. The Forest Plan requires a certain percent of the Forest be maintained in mature and old growth forest, and protects special habitats such as springs, seeps, fens, fishless ponds, caves, and glades that may harbor salamander species.

In 2001 the Mark Twain National Forest completed an analysis of the new Regional Forester Sensitive Species (RFSS) on the February 29, 2000 species list. This SIR along with its background information report contained information on all 127 RFSS, their unique needs and the habitats they utilize. The Forest Plan goals and objectives, management prescriptions, standards and guidelines are appropriate to meet the needs of all the 127 RFSS. The above conclusions from this analysis are documented in a Supplemental Information Report (SIR) dated June 27, 2001.

Partners in Flight (PIF) completed the Bird Conservation Plan for the Prairie Peninsula (Physiographic Region 31) in February 2000. This region includes parts of Missouri, Illinois, Indiana and Ohio. According the plan, "Historically tallgrass prairie, savanna and forest habitats were interspersed across the

Prairie Peninsula physiographic region. During and following settlement, both prairie and woodlands were converted to pasture, hayfields and cropland. Today, almost 70% of the planning unit is in corn and soybeans.” “As with native prairie, less than 1% of the original savanna/woodland acreage is estimated to be present in the Prairie Peninsula today”. Large areas have been converted to cities, suburbs and small acreage farms or ranches. *Note: large openings of monocultures (such as lawns and/or alfalfa fields) that are mowed regularly do not provide any suitable grassland habitat for birds.* The increased amount of feral cats is also a concern. The increased use of some pesticides and herbicides on farm or near homes may also be a concern. Nest parasitism by Brown-headed Cowbirds is also a problem in the Prairie Peninsula Physiographic Region. (PIF 2000)

The priority species from the Bird Conservation Plan for the Prairie Peninsula include the Greater Prairie Chicken (grasslands), Henslow’s sparrow (grasslands), Dickcissel (grasslands), Bells’ Vireo (shrubland), Cerulean Warbler (deciduous forest), Red-headed Woodpecker (deciduous forest), and the Eastern Wood Pewee (deciduous forest).

Missouri has established a Neo-tropical Bird Working Group composed of experts from the Missouri Department of Conservation, Mark Twain National Forest, North Central Forest Experiment Station, and the University of Missouri. The Missouri Working Group is a part of the national Partners in Flight (PIF) effort and was created to evaluate threats to these species in Missouri and develop a list of species of concern for Missouri.

The above group has drafted a list, which are ranked according to the threats to the species in Missouri. The work of this group highlights the fact that breeding habitat for neo-tropical migratory birds includes all successional stages and all types of habitat and is not only large areas of unbroken woodland. The loss of wintering habitat (including area’s outside of the United States) is also a concern. Results of this preliminary list show the top three birds of concern and their habitats in Missouri are: Swainson's warbler (riparian/cane), Bachman's sparrow (glades/savannas/open pine woods), and dickcissel (open land).

The most recent research by North Central Forest Experiment Station suggests that the type of landscape that surrounds an area has much to do with what effects occur on Neo-tropical migrant songbirds. This research has shown that landscapes which are fragmented by large blocks of agriculture (pastures & crops) or human development (subdivisions, shopping malls, towns, businesses, etc) and have only a small proportion of forest, such as southern Illinois, show the greatest negative impacts on neo-tropical songbirds from cowbirds and possibly other nest predators. There is no one single habitat that meets the needs of all the different species.

Bats surveys by the North Central Forest Experiment Station involving the use of Mist Nets and/or Anabats are being conducted in the Middle River Project area during 2003.

Summary:

No prescribed fire would occur in alternative 1. No additional old growth would be designated in Alternative 1.

Alternative 2 and 3 would slightly reduce the amount of open areas in order to meet Forest Plan objectives by not allowing prescribed burning, grazing and/or mowing to occur in some areas. In addition hardwoods would be planted in some of the above areas. A diversity of forest management practices

would meet the habitat needs of songbirds better than any one practice. Both alternative 2 and 3 would use prescribed fire that would maintain some areas in a semi-open brushy environment,

Alternative 2 does include some uneven age timber harvest. This would help to create some savanna like areas. Temporary brushy openings of varying sizes would be created through uneven-aged harvest.

In summation all alternatives would help to meet the habitat requirements of all species. There would be no conversion of forest to permanent non-forest uses in any alternative of the Middle River Project.

6. Maintain unique or sensitive environments.

See items 2, 3 and 5 above for additional information and for items that address the unique and sensitive environments. The activities in the Middle River project would help to maintain the unique or sensitive environments in the area.

7. Maintain or mimic natural ecosystem processes.

See items 2, 3 and 5 above for additional information and for items that maintain or mimic natural ecosystem processes. The activities in the Middle River project would help to maintain or mimic natural ecosystem processes.

8. Maintain or mimic naturally occurring structural diversity.

Also see items 2, 3 and 5 above for additional information and for items that maintain or mimic naturally occurring structural diversity. The activities in the Middle River project would help to maintain or mimic naturally occurring structural diversity.

Historic and natural disturbance factors include fairly frequent low intensity fires, with infrequent high intensity (or stand replacement) fires; windstorms & tornadoes; occasional summer drought and/or late spring frosts; insect/disease mortality; and flash flooding in intermittent drainages and permanent streams. These disturbances formed a mosaic of successional stages of the oak-hickory forest. Small openings resulting from wind throw, insect/disease, or natural mortality were probably frequent, with larger openings caused by stand-replacement fires, drought, frost and tornadoes probably infrequent across the landscape. In addition, soil fertility helped determine the species composition and density of vegetation. Poorer soils had less density of tree species and more herbaceous under stories, while richer soils had a higher density of tree species along with a varied mid-story of shrubs and small trees and less herbaceous ground cover.

Summary:

Normally alternative 1 may come the closest to allowing natural processes to operate. However, fire suppression activity would continue, therefore contributing to a denser forest. This would result in the loss of open and semi-open areas such as savannas and prairies. Therefore Alternative 1 has the greatest potential off all alternatives to move the Middle River area away from historic conditions. No additional old growth would be designated in Alternative 1.

The Uneven-aged management in Alternative 2 (either single tree or group selection) would create the smaller and more numerous openings typical of most natural disturbances. This would help to maintain the diversity in the Middle River area

Designation of old growth in Alternative 2 and 3 allows for the formation of the older, late successional stages that have been lacking since the late 1800's/early 1900's.

Prescribed burning that would encourage growth of herbaceous ground cover would occur in Alternatives 2 and 3. This would also help portions of the area maintain the more open characteristic it historically had.

9. Protect genetic diversity.

See items 2 - 5 above for additional information and the items that address the genetic diversity.

"To preserve genetic adaptations, species should be maintained in natural habitats across their natural ranges, and plants and animals for reintroduction should be selected from ecologically similar areas as close to the restoration site as feasible." (CEQ General Principles- Page 7).

Summary:

There would be no attempt to physically move any plant or animal species from somewhere else into the Project Area in any alternative.

Natural vegetative disturbances or human-caused wild land fires (and the associated fire suppression activities) would affect the Project Area in Alternative 1. The area would move toward a higher percent in mature or older successional stages. However, larger numbers of dead and dying trees would occur. Cavity dependent species and species dependent on dead and downed woody material would increase in the short term.

Alternatives 2 and 3 would attempt to maintain the type and amount of disturbance which create a mix of "natural habitats" within the oak-hickory ecosystem as well as minimize adverse impacts from insects and disease on forest vegetation. A range of successional stages would be provided and non-native species would be discouraged (see discussion under #4). By maintaining the range of successional stages of communities on appropriate sites, genetic variations and the ability to adapt are also maintained.

10. Restore ecosystems, communities, and species.

Species extirpated from Missouri within historic times include: red & gray wolf, cougar, red-cockaded woodpecker, elk, and bison. The Missouri Department of Conservation is responsible for wildlife populations. Species successfully recovered or reintroduced in the Lower Ozarks from the 1930's until the present include: deer, turkey, beaver, ruffed grouse, and river otter.

Some species that are relatively uncommon in Missouri are naturally moving back into the state. In the past several years, black bear and armadillo sightings have been more frequent in the Lower Ozarks south of the Project Area. It appears that both these species are expanding their ranges by moving into southern Missouri from adjoining states. The Missouri Department of Conservation has a Black Bear Management Plan, but has no immediate plans to actively reintroduce bears to the state. They are monitoring bear

sightings and responding to situations where bears and people come in conflict. Armadillos make recurring attempts to move north and are usually decimated during extended periods of extremely cold weather. The last several winters in south Missouri have been relatively mild, allowing the expansion of armadillo populations.

Natural communities that have been altered or reduced within historic times include: prairies, savannas, large fens, open woods and old growth. Forests with more woody understory plants have gradually replaced open woods typical of poor soils and/or ridge tops as fire protection kept out frequent low-intensity fires. Old growth forests were almost completely wiped out during the logging boom of the late 1800's and early 1900's.

Summary:

See #2 – 5 above, and fire history for discussions of how natural communities would be affected by each alternative.

11. Monitor for biodiversity impacts. Acknowledge uncertainty. Be flexible.

Ecosystems are complex and the interrelationships often difficult to understand. There is much research being done on various aspects of ecosystem composition, structure and function. In Missouri, efforts are underway by the Missouri Department of Conservation, Missouri Department of Natural Resources, United States Geological Survey, USDI National Park Service, USDA Forest Service, the Missouri Universities, and other organizations or private businesses to study many of these subjects. These agencies along with other state, federal, and private Midwestern organizations are applying promising methodologies in restoring and maintaining ecosystems in the Midwest. The Missouri Resource Assessment Project (MoRAP) is measuring the effects of forest management on many species of animals and plants. This work is ongoing.

At the present time, there are no studies being done specifically within the Project Area. This area would be available for future research/studies under all Alternatives.

Summary:

Alternatives 2 - 3 all contain various mitigation measures and provisions for monitoring. See Chapter 2 of this EA for additional information. In addition, normal contract administration monitors actions carried out under contract. District persons visit different areas to informally monitor compliance with specifications and the results of various activities. Formal monitoring also occurs at the District and Forest level.

12. Incorporate human needs.

The objectives of the Forest Plan incorporate human needs as a part of management of the ecosystem (LRMP IV – 1, 2, 13, 27 – 36, 115, 117, 185, 188).

These objectives can be met by maintaining traditional uses while providing for changing societal needs within the limits of ecosystem capability.

Also see items 1 and 3 above, which contain information on the human needs and use in the area.

Summary:

Traditional uses such as hunting, fishing, hiking, berry-picking and horseback riding would still be possible under any alternative. Driving for pleasure would still be possible in all alternatives. Nature enthusiasts seek out special habitats to observe, photograph, and study rare and unusual non-game plant and animal species. The existing road system would still exist in all alternatives.

Game species such as doves, rabbits, quail and deer that prefer early successional habitats would be less abundant in Alternative 1, therefore, hunting success might be lower for these species. Game species such as turkey, raccoon, and squirrel, which prefer mid to late successional habitats would be more abundant in Alternative 1; thus leading to the possibility of higher hunter satisfaction.

Conversely, in Alternative 2 - 3, early successional species (and hunting success) would be relatively higher and late successional species relatively lower than Alternative 1.

There would be no commercial wood products removed from the Middle River Project Area under Alternatives 1 and 3. Wood products removed in Alternative 2 would help to supply wood to local sawmills. Firewood would be available with a permit in Alternatives 2. All alternatives maintain the opportunity to provide goods & services in the future.

Cumulative Effects on Biological Diversity

Protect Communities and Ecosystems: Natural communities are protected/managed on appropriate sites according to Forest Plan standards and guides in all management activities, including all alternatives in the Middle River Project Area. Unique or sensitive communities are protected and managed to enhance and perpetuate their special characteristics. The effect of past and current management has been to perpetuate an oak-hickory forest ecosystem composed of all successional stages well distributed throughout the landscape. In addition, unique communities are recognized, restored and managed if necessary to retain their uniqueness. Future management is expected to result in a similar composition and distribution of natural communities. However, if management practices were not implemented open and semi-open habitat (such as savanna') would continue to be lost due to forest succession. In addition there would be a decrease in the diversity of the forests in the Middle River area.

Minimize Fragmentation: The oak-hickory forest ecosystem is naturally fragmented due to natural processes (windstorm, natural mortality, frost, flood, fire, etc.) in terms of age classes, forest types, and interspersions of natural openings (glades, river corridors, areas of tree mortality). Management activities in the Oak Hickory Hills LTA's within the past decades have tended to perpetuate this diversity, particularly in age class distribution. Wildlife openings created in the past on inappropriate sites have been allowed to succeed back to their natural structural composition; while recent work has concentrated on restoring oak savannah conditions which have been lost due to effective fire suppression over the past 50 years.

Continued management of the forest with commercial timber harvest and restoration of natural communities should continue to provide a forest ecosystem that is varied in species composition and structure. Distribution of various age-classes and types should be approximately the same as it is now. There would continue to be permanent edges between forest and non-forest land uses (roads, private land

pastures, other developments), as well as temporary edges between forest age classes and types. Temporary edges would not be static, but would be varied in distribution over time. However, they should continue to be approximately the same amount as currently exists. Potential effects to vegetation on private lands are discussed above under cumulative effects on vegetation.

Due to the increasing population in the area, land use conversions to home-sites would continue on private lands.

Promote Native Species: The forest and district would continue to manage native species on appropriate sites and avoid introducing non-native species. However, non-native plant species are used extensively on adjacent private lands and are ubiquitous on area roadsides. It would be very difficult, and in some cases undesirable, to attempt to eradicate all non-native plant/animal species. Although creation of areas of disturbed soil in this and other projects would provide areas for colonization of some non-native plant species, these are not necessarily undesirable and would not normally affect the viability of native species within the project area.

Protect rare and ecologically important species: Natural forces and past management activities have created a forested landscape with all successional stages of the oak-hickory forest represented. Small areas of special habitats or unique natural communities exist and are protected in all alternatives of the Middle River Project Area, as well as other proposed projects in these Land Type Associations. Future management would be done to implement the Forest Plan and try to move towards the desired future condition described in the Plan. What that means for listed species is that the types of habitats currently available would continue to be available in approximately the same amount and distribution. Special habitats and unique natural communities would continue to be protected and/or managed to retain their unique characteristics. Although it is possible that individual animals of some species would be affected by management activities, it is very unlikely that the viability of local or regional populations of any listed species would be adversely affected.

The 3.4 Management Area Prescription, over the next 10 years, would continue to provide a variety of well-distributed habitat types. Large blocks of forest canopy would still be available within the Middle River Project Area.

Maintain Unique or Sensitive Environments: Unique and special areas are protected in all management activities through application of Forest Plan standards and guides. Within the 3.4 Management Prescription Areas, in the next 10 years, all special areas would be protected and/or managed to retain/restore/enhance their unique characteristics.

Maintain or Mimic Natural Ecosystem Processes and Naturally Occurring Structural Diversity: The Middle River Project Area, within the 3.4 Management Area Prescriptions and the management activities in the Oak Hickory Hills (HP) LTAs would continue to provide a variety of forest ages, sizes, species composition, and structures due to normal forest management (according to Forest Plan standards and guides) and natural processes, including prescribed burning to mimic historic fires.

Protect Genetic Diversity: Genetic interactions could take place. Vegetation would continue to provide a variety of age classes, sizes and species distribution. No permanent changes in land use are planned (i.e. the forest areas would remain forested), and there would not be elimination of any species.

Restore ecosystems, communities, and species: All the above apply.

Incorporate human needs:

The human needs would continue to meet in the Middle River Project Area and on the surrounding private lands. The needs for grazing areas and limited wood products would be met. This includes opportunities for sightseeing, hunting, fishing, camping and other activities. However, the amount of non developed open areas would continue to decline due to the increased population in the area.

APPENDIX D

Economic Analysis Tables

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**Middle River Project Area Economic Analysis
Houston/Rolla/Cedar Creek District**

Table 26: Timber Sale Economics of Existing Stands Alternative 2	
COSTS:	
Sale Prep/Administration (645 MBF @ \$46/MBF)	\$29, 267
Site Prep (UEAM, 460 ac @ \$50/ac)	\$23,000
Stocking Survey (460 ac @ \$5/ac)	\$ 2,300
Total Costs	\$54,567
REVENUES:	
Oak Sawtimber (516 MBF @ \$100/MBF)	\$51,600
Cedar Sawtimber (129 MBF @ \$35/MBF)	\$ 4,515
Firewood (920 Cords @ \$5/Cd)	\$ 4,600
Total Revenue:	\$60,715
Net Sale Revenue:	\$ 6,148
Sale Revenue/Cost Ratio	1.1
OTHER COSTS:	
Road Reconstruction (FR1686, 0.9 mile @ \$10,000/mi)	\$ 9,000
Road Closure (0.4 mi @ \$1000/mi)	\$ 400
Prescribed Burning (650 ac @ \$30/ac)	\$19,500
Plant Native Hardwoods (45 ac @ \$100/ac)	\$ 4,500
Herbicide Use (59 ac spot treatment for a total of 5 ac @ \$100/ac)	\$ 500
Fencing (1 mile)	\$ 5,000
Pond Reconstruction	\$ 5,000
Improve Parking and Access	\$1,000
Erosion Control/Planting	\$ 500
TOTAL OTHER COSTS:	\$45,400

**Middle River Project Area Economic Analysis
Houston/Rolla/Cedar Creek District**

Table 27: Timber Sale Economics of Existing Stands Alternative 3	
COSTS:	
Sale Prep/Administration (645 MBF @ \$46/MBF)	\$29, 267
Site Prep (UEAM, 460 ac @ \$50/ac)	\$23,000
Stocking Survey (460 ac @ \$5/ac)	\$ 2,300
Total Costs	\$54,567
REVENUES:	
Oak Sawtimber (516 MBF @ \$100/MBF)	\$51,600
Cedar Sawtimber (129 MBF @ \$35/MBF)	\$ 4,515
Firewood (920 Cords @ \$5/Cd)	\$ 4,600
Total Revenue:	\$60,715
Net Sale Revenue:	\$ 6,148
Sale Revenue/Cost Ratio	1.1
OTHER COSTS:	
Road Reconstruction (FR1686, 0.9 mile @ \$10,000/mi)	\$ 9,000
Road Closure (0.4 mi @ \$1000/mi)	\$ 400
Prescribed Burning (688 ac @ \$30/ac)	\$20,640
Plant Native Hardwoods (8 ac @ \$100/ac)	\$ 800
Herbicide Use (59 ac spot treatment for a total of 5 ac @ \$100/ac)	\$ 500
Fencing (1 mile)	\$ 5,000
Pond Reconstruction	\$ 5,000
Improve Parking and Access	\$1,000
Erosion Control/Planting	\$ 500
TOTAL OTHER COSTS:	\$42,840

APPENDIX E

Soil Characteristics Tables

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Table 28: Soil Type: Armstrong loam

	Characteristics
Landscape Location	The Armstrong series consists of very deep, moderately well drained or somewhat poorly drained, slowly permeable soils formed on uplands in 10 to 20 inches of sediments or loess and in the underlying paleosol weathered from glacial till. Slope ranges from 2 to 25 percent.
Stand Location	Compartment 9: 14, 19, 20, 23, 24, 28, 42;
Water-Holding Capacity	8.3 – 11.0 inches
Permeability	Moderate (surface soil), Slow (upper subsurface), moderately slow (lower subsurface)
Total Depth	48 – 80 inches solum
A Horizon Depth	6 – 10 inches thick
Rock content in surface horizon	0 – 5 percent
Erosion Hazard & Equipment Limitation	Moderate suited to harvesting equipment. Slight erosion hazard off roads and skid trails. Moderate to severe erosion hazard on roads and skid trails.
Potential for damage to soil by fire	Low potential
Suitability for pond development	Moderate to severe limitation due to slope.
Management Considerations	Perched water table at 1.0 – 3.0 feet thick typically from November to May.

Table 29: Soil Type: Bethesda silty clay loam

	Characteristics
Landscape Location	The Bethesda series consists of deep, well drained soils with moderately slow permeability formed in acid regolith from surface mine operations. The regolith is a mixture of partially weathered fine earth and fragments of bedrock. Fragments of rock consist mainly of acid shale, siltstone, coal, and medium and fine-grained sandstone. Slopes range from 0 to 90 percent.
Stand Location	Compartment 9: Stand Nos. 37 & 53
Water-Holding Capacity	2 ½ - 6 ½ inches
Permeability	Moderately slow
Total Depth	60 inches
A Horizon Depth	0 – 7 inches
Rock content in the surface horizon	0 – 15 percent, Small shale fragments may comprise up to 30 percent.
Erosion Hazard & Equipment Suitability	Moderate to severe erosion hazard due to slope and erodability. Moderately suited to harvesting equipment.
Potential for damage by fire	High potential due to texture, slope, coarse fragments
Suitability for pond development	Severe limitations due to slope
Management Considerations	May require reclaiming for vegetative growth.

Table 30: Soil Type: Calwoods silt loam

	Characteristics
Landscape Location	The Calwoods series consists of very deep, somewhat poorly drained, very slowly permeable soils formed in loess or loess and pedisegment or glacial till. These soils are on broad summits and have slopes of 1 to 5 percent.
Stand Location	Compartment 9: Stand Nos. 19 – 2, 23, 24, 52
Water-Holding Capacity	10 – 12 inches
Permeability	Moderate (upper surface), moderately slow (lower surface), very slow (subsurface)
Total depth	60 inches
A Horizon Depth	4 – 13 inches
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight erosion hazard off roads and skid trails, Moderate hazard on roads and skid trails due to slope and erodability. Moderately suited to harvesting equipment.
Potential for damage from fire	Low
Suitability for pond development	Moderate limitations due to slope.
Management Considerations	Perched water table at 1.0 – 2.5 feet typically from November to April.

Table 31: Soil Type: Cedargap gravelly silt loam

	Characteristics
Landscape Location	The Cedargap series consists of very deep, well drained, moderately and moderately slowly permeable soils formed in cherty alluvium with a high content of chert fragments. These soils are on flood plains of small streams near active channels. Slopes range from 0 to 3 percent.
Stand Location	Compartment 9: Stand Nos. 2, 17, 25, 32, 34, 54, 55
Water-Holding Capacity	4 ½ - 8 ½ inches
Permeability	Moderate
Total depth	60 inches
A Horizon Depth	6 – 24 inches
Surface rock content	3 – 60 percent
Erosion Hazard & Equipment Limitation	Slight hazard for erosion. Moderately suited for harvesting equipment.
Potential for damage from fire	Low
Suitability for pond development	Moderate limitation due to seepage.
Management Considerations	Brief, frequent flooding from November to May.

Table 32: Soil Type: Gasconade flaggy clay loam

	Characteristics
Landscape Location	The Gasconade series consists of shallow and very shallow, somewhat excessively drained, moderately slowly permeable soils formed in thin clayey layers with a considerable amount of coarse fragments from residuum of the underlying limestone bedrock. These soils are on steep dissected upland landscapes and generally are isolated glade areas. Slope gradients range from 2 to 50 percent.
Stand Location	Compartment 9: Stand Nos. 1 – 27, 30, 32, 34 – 37, 40, 41, 44 – 47, 49, 53 – 56; Compartments 10: 1 – 16, 18 – 21, 31, 33 – 36
Water-Holding Capacity	1.3 – 1.7 inches
Permeability	Moderate (surface), moderately slow (subsurface)
Total depth	4 – 20 inches
A Horizon Depth	4 – 10 inches
Surface rock content	0 – 70
Erosion Hazard & Equipment Limitation	Moderate erosion hazard due to slope and erodability. Moderate suitability for harvesting equipment.
Potential for damage from fire	Low
Suitability for pond development	Severe limitation due to depth of rock, seepage, and slope.
Management Considerations	Low soil depth and water holding capacity. Occurs on landscapes generally isolated as glades.

Table 33: Soil Type: Gorin silt loam

	Characteristics
Landscape Location	The Gorin series consists of very deep, somewhat poorly drained, slowly permeable soils formed in loess and loamy sediments or loess, loamy sediments and a paleosol from glacial till. These soils are on ridgetops and have slopes ranging from 2 to 14 percent.
Stand Location	Compartment 9: Stand Nos. 10, 11, 13 – 15, 18, 35 – 37, 40 – 42, 44, 46, 47, 49, 53, 56; Compartment 10: Stands Nos. 1, 2, 5, 8, 16 – 19, 22, 25, 30 – 35, 37.
Water-Holding Capacity	10 – 12 inches
Permeability	Moderate (surface), slow to moderately slow (upper subsurface), moderately slow (lower subsurface)
Total depth	48 – 60
A Horizon	2 – 5 inches
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight erosion hazard off roads and trails. Moderate hazard due to slope and erodability on roads and skid trails. Moderately suited to harvesting equipment.
Potential for damage from fire	Low
Suitability for pond development	Moderate limitation due to slope.
Management Considerations	Perched water table at 2.0 – 4.0 feet from November to April.

Table 34: Soil Type: Goss gravelly silt loam

	Characteristics
Landscape Location	The Goss series consists of very deep, well drained, moderately permeable soils formed in colluvium and the underlying residuum weathered from cherty limestone or cherty dolomite and some interbedded shale. These soils are on uplands. Slopes range from 1 to 70 percent.
Stand Location	Same as for Gasconade
Water-Holding Capacity	2 ½ - 6 inches
Permeability	Moderately fast (surface and upper subsurface), moderate (lower subsurface)
Total depth	80 inches
A Horizon	2 – 8 inches
Surface rock content	5 – 75 percent
Erosion Hazard & Equipment Limitation	Moderate hazard off roads and trails due to slope and erodability. Severe hazard on roads and skid trails due to slope and erodability. Moderately suited to harvesting equipment, limited by soil strength and slope.
Potential of damage from fire	Low
Suitability to pond development	Severe limitations due to slope.
Management Considerations	Low to very low available water holding capacity.

Table 35: Soil Type: Haymond silt loam

	Characteristics
Landscape Location	The Haymond series consists of very deep, well drained, moderately permeable soils that formed in silty alluvium. These soils are on flood plains and flood-plain steps. Slope ranges from 0 to 3 percent.
Stand Location	Compartment 9: Stand Nos. 2, 3, 7, 8, 10, 54
Water-Holding Capacity	12 – 13 ½ inches
Permeability	Moderate
Total depth	60 inches
A Horizon Depth	7 – 12 inches
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight erosion hazard. Moderately suited to harvesting equipment, limited due to soil strength.
Potential of damage from fire	Low
Suitability for pond development	Moderate limitation due to seepage
Management Considerations	Occasional, brief flooding from November thru May.

Table 36: Soil Type: Keswick loam	
	Characteristics
Landscape Location	These soils are on convex summits of interfluvies and convex side slopes and on narrow, lower-stepped interfluvies or on the shoulders of side slopes where geologic erosion has exhumed the Late Sangamon paleosol. Slope gradients commonly are 5 to 20 percent, but range up to 25 percent. Keswick soils formed mostly in reddish-colored Late Sangamon paleosols, but the horizons above the pebble band formed partly in loess or loess and pedisements.
Stand Location	Compartment 9: Stand Nos. 5, 10 – 15, 18 – 30, 37, 40 – 54, 56; Compartment 10: Stand Nos. 1 – 3, 9, 13 – 15, 17, 20 – 34, 36, 37, 39
Water-Holding Capacity	7 – 9 ½ inches
Permeability	Moderate (surface); Slow (upper subsurface); Moderately slow (lower subsurface)
Total depth	48 – 75 inches
A Horizon Depth	2 – 5 inches
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight to moderate hazard off roads and skid trails (due to slope and erodability). Moderate to severe hazard on roads and skid trails (due to slope and erodability). Moderately suited to harvesting equipment (limitation due to soil strength).
Potential for damage from fire	Moderate potential (texture, coarse fragments)
Suitability for pond development	Moderate to severe limitation due to slope
Management Considerations	Perched water table at 1.0 – 3.0 feet (November to May)

Table 37: Soil Type: Landes fine sandy loam	
	Characteristics
Landscape Location	Landes soils are on natural levees, low terraces, and bars on flood plains. Slopes commonly are 0 to 3 percent, but range to as steep as 7 percent. These soils formed in loamy and sandy alluvium of recent origin that is stratified with subtle differences in texture or organic carbon content.
Stand Location	Compartment 9: Stand Nos. 2, 8
Water-Holding Capacity	7 – 10 inches
Permeability	Surface (Moderate to moderately rapid); Subsurface (Moderately rapid)
Total depth	60 inches
A Horizon	10 – 20 inches
Surface rock content	0 – 20 percent
Erosion Hazard & Equipment Limitation	Slight erosion hazard. Moderately suited to harvesting equipment (limitation due to soil strength).
Potential for damage from fire	Moderate due to texture and coarse fragments.
Suitability for pond development	Severe limitation due to seepage
Management Considerations	Frequent, brief flooding from November thru May.

Table 38: Soil Type: Lindley loam	
	Characteristics
Landscape Location	Lindley soils are on valley side slopes and narrowly dissected interfluves. The slope gradients range from 5 to 60 percent. The soils are thought to have formed in pre-Illinoian glacial till and they may have a thin mantle of loess.
Stand Location	Compartment 9: Stand Nos. 3, 4, 28, 30, 34 – 37, 40 – 42, 44, 51, 53; Compartment 10: 5 – 8, 16, 17, 22 m- 25, 31, 38
Water-Holding Capacity	8 – 10 inches
Permeability	Moderate (surface); moderately slow (subsurface)
Total depth	40 – 60+
A Horizon depth	1 – 4 inches thick
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight to moderate hazard off road and skid trail (due to slope and erodability). Severe erosion hazard on roads and skid trails (due to slope and erodability). Moderately suited to harvesting equipment (limitations due to strength and, in some cases, slope).
Potential of damage from fire	Low
Suitability to pond development	Severe limitation due to slope
Management Considerations	

Table 39: Soil Type: Mexico silt loam	
	Characteristics
Landscape Location	Mexico soils are on slopes of the main divides. These soils formed in 30 to 60 inches of loess or loess and pedisegment. Slopes range from 1 to 5 percent.
Stand Location	Compartment 9: Stand 42
Water-Holding Capacity	9 – 12 inches
Permeability	Moderate (surface); upper subsurface (moderately slow); very slow (mid subsurface); moderately slow (lower mid subsurface), very slow (lower subsurface)
Total depth	Up to 60
A Horizon Depth	6 – 10 inches thick
Surface rock content	0 - 5
Erosion Hazard & Equipment Limitation	Slight erosion hazard off roads and skid trails. Moderate erosion hazard on roads and skid trails due to slope and erodability. Moderately suited for harvesting equipment (limitation due to level of soil strength).
Potential of damage from fire	Low potential (limitation due to texture and coarse fragments)
Suitability for pond development	Moderate limitation due to slope
Management Considerations	Perched water table at 1.0 – 2.5 feet (November to May).

Table 40: Soil Type: Weller silt loam	
	Characteristics
Landscape Location	Most of the Weller soils are on convex ridgecrests and side-valley slopes surrounding the nearly level, stable, upland divides in the loess-covered Kansan till plain. Some are on benches. Slope gradients are from about 0 to 14 percent. These soils formed in loess (Wisconsin) low in sand (less than 5 percent).
Stand Location	Compartment 9: Stand Nos. 1 – 3, 8, 9, 46, 56; Compartment 10: Stand No. 4
Water-Holding Capacity	9 – 12 inches
Permeability	Moderate (surface); slow (upper subsurface); moderately slow (lower subsurface)
Total depth	48 – 75 inches
A Horizon Depth	3 – 9 inches
Surface rock content	0 – 5 percent
Erosion Hazard & Equipment Limitation	Slight erosion hazard off roads and skid trails. Moderate erosion hazard on roads and skid trails (slope and erodability). Moderately suited to harvesting equipment (limitation based on level of soil strength)
Potential of damage from fire	Low to moderate (texture and coarse fragments)
Suitability for pond development	Moderate to severe limitation based on slope.
Management Considerations	Perched water table at 2.0 – 4.0 feet. (November thru May).

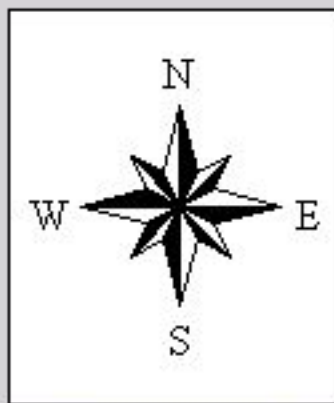
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APPENDIX F

Middle River Project Maps

Mark Twain National Forest
Houston/Rolla/Cedar Creek R.D.
Middle River Project
Alternative #2
Compartment 9
Treatment Map #1

The US DA Forest Service uses the most current available data available. GIS data and product accuracy may vary. GIS products for purposes other than those for which they were intended may yield inaccurate or misleading results. The US DA Forest Service reserves the right to correct, modify, or replace GIS products without notification.



msh 8-5-03

T46N, R10W

T45N, R10W

Legend---Alternative 2

- C9---20-30% Forbs, Grasses, Shrubs
- C9---Old Growth
- C9---Plant/Increase Woodland Habitat
- C9---Reduce Noxious Weeds
- C9---Parking Lots
- Erosion Control
- Lakes
- Streams
- Stand Boundary
- Ownership**
 - National Forest
 - Private
- Road System**
 - State Highway
 - County Road
 - Forest Road
 - FS Non-System

State Hwy-BB

County Road-432

County Road-432

Mark Twain National Forest
Purchase Unit Boundary

Mark Twain National Forest
Purchase Unit Boundary

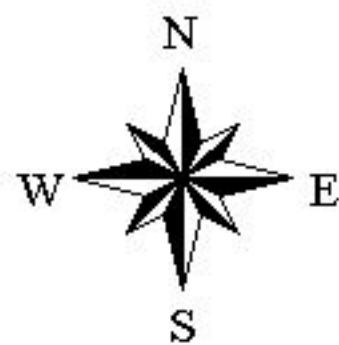
0.25 0 0.25 0.5 0.75 M



Mark Twain National Forest
Houston/Rolla/Cedar Creek R.D.
Middle River Project
Alternative #2
Compartment 9
Treatment Map #2

The USDA Forest Service uses the most current and data available. GIS data and product accuracy may vary for purposes other than those for which were intended may yield inaccurate or misleading results. The USDA Forest Service reserves the right to correct, modify, or replace GIS products without notification.

Mark Twain National Forest
Purchase Unit Boundary



msh 7-30-03

T46N, R10W

T45N, R10W

Legend---Alternative 2

- C9---Open/Semi-open habitat w/Burning
- C9---Prescribed Burn
- Pond Rehabilitation
- 7513 (Road Closure)
- C9---Fence
- Lakes
- Streams
- Stand Boundary
- Ownership**
 - National Forest
 - Private
- Road System**
 - State Highway
 - County Road
 - Forest Road
 - FS Non-System

0.25 0 0.25 0.5 0.75 Mile

State Hwy-BB

County Road-432

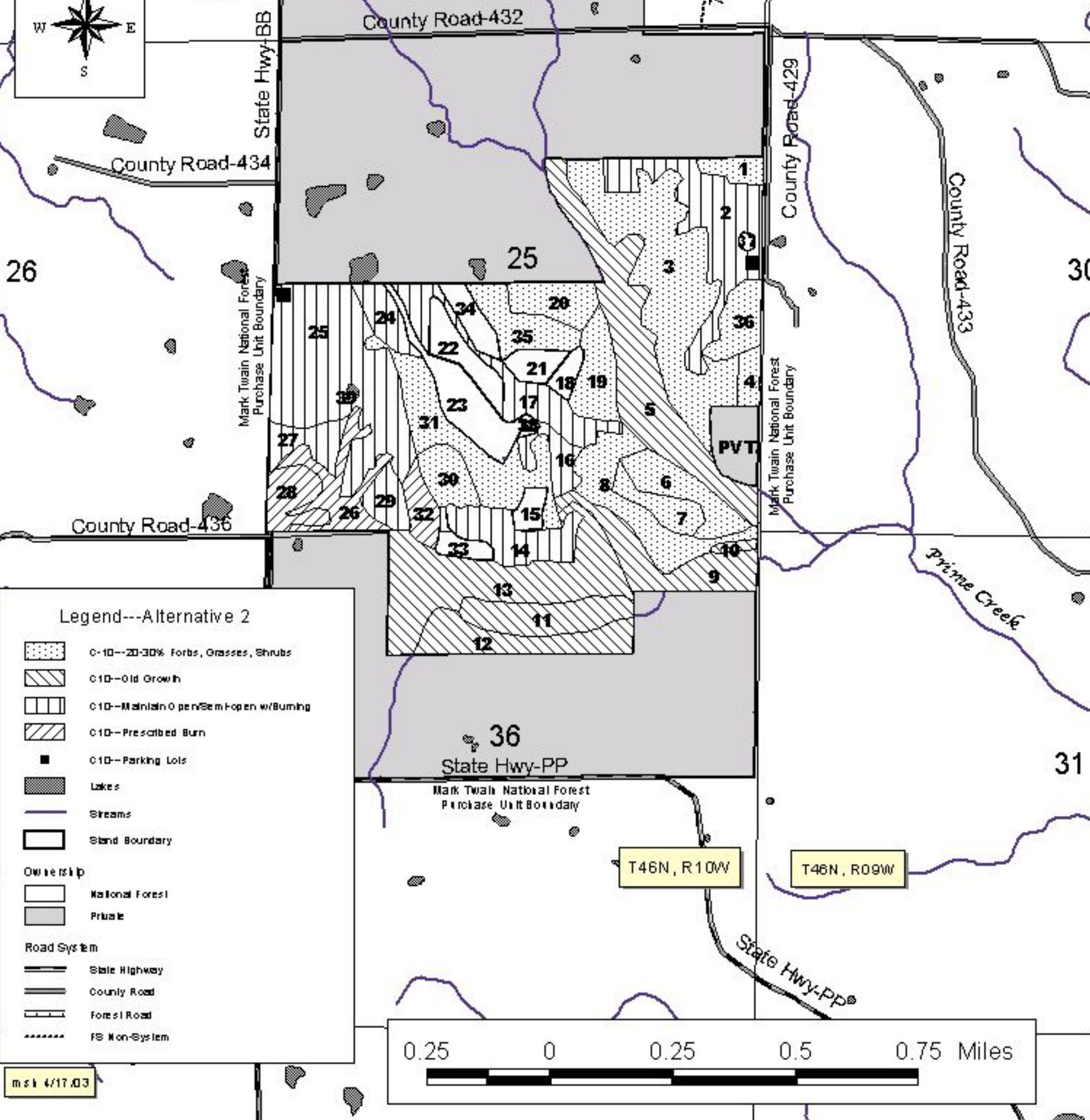
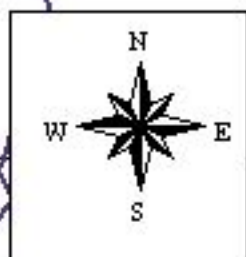
County Road-

Mark Twain National Forest

Mark Twain National Forest
Purchase Unit Boundary

Mark Twain National Forest
Houston/Rolla/Cedar Creek R.D.
Middle River Project
Alternative #2
Compartment 10
Treatment Map #3

The USDA Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. Using GIS products for purposes other than those for which they were intended may yield inaccurate or misleading results. The USDA Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.



Mark Twain National Forest
Houston/Rolla/Cedar Creek R.D.
Middle River Project
Alternative #3
Compartment 9
Treatment Map #4

The US DA Forest Service uses the most current and data available. GIS data and product accuracy may vary. GIS products for purposes other than those for which were intended may yield inaccurate or misleading results. The US DA Forest Service reserves the right to correct, modify, or replace GIS products without notification.

Mark Twain National Forest
Purchase Unit Boundary

County Road 412

County Road 412

Mark Twain National Forest
Purchase Unit Boundary

Middle River

Mark Twain National Forest
Purchase Unit Boundary

County Road 432

County Road 434

429



msh 7-30-03

14

T46N, R10W

T45N, R10W

Legend---Alternative 3

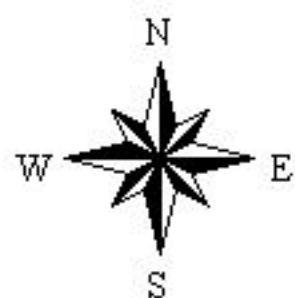
- C9---20-30% Forbs, Grasses, Shrubs
- C9---Old Growth
- C9---Plant/Increase Woodland Habitat
- C9---Reduce Noxious Weeds
- C9---Parking Lots
- Erosion Control
- Lakes
- Streams
- Stand Boundary
- Ownership**
 - National Forest
 - Private
- Road System**
 - State Highway
 - County Road
 - Forest Road
 - FS Non-System

0.25 0 0.25 0.5 0.75 Miles



Mark Twain National Forest Houston/Rolla/Cedar Creek R.D. Middle River Project Alternative #3 Compartment 10 Treatment Map #6

The USDA Forest Service uses the most current and cor data available. GIS data and product accuracy may vary GIS products for purposes other than those for which the were intended may yield inaccurate or misleading results The USDA Forest Service reserves the right to correct, u modify, or replace GIS products without notification.



msh 7-30-03

State Hwy-BB
County Road-434
County Road-432
County Road-429
County Road-436
State Hwy-PP
T46N, R 10W
T46N, R09W

Legend---Alternative 3

- C-10---20-30% Forbs, Grasses, Shrubs
- C10---Old Growth
- C10---Maintain Open/Semi-open w/Burning
- C10---Prescribed Burn
- C10---Erosion Control
- C10---Parking Lots
- C10--Fence

- Lakes
- Streams
- Stand Boundary

- Ownership
- National Forest
 - Private

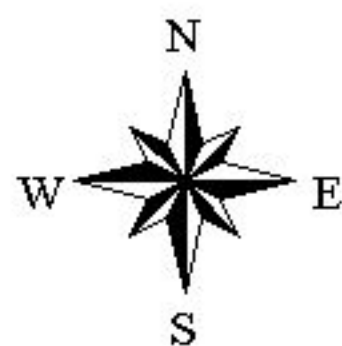
- Road System
- State Highway
 - County Road
 - Forest Road
 - FS Non-System

0.25 0 0.25 0.5 0.75 Mile:



Mark Twain National Forest
Houston/Rolla/Cedar Creek R.D.
Middle River Project
Alternative #3
Compartment 9
Treatment Map #5

The USDA Forest Service uses the most current available data. GIS data and product accuracy may vary for purposes other than those for which the data were intended. The USDA Forest Service reserves the right to correct, modify, or replace GIS products without notification.



msh 7-30-03

T46N, R10W

T45N, R10W

Legend---Alternative 3

- C9---Maintain Open/Semi-open w/Burning
- C9---Prescribed Burn
- Pond Rehabilitation
- 7513 (Road Closure)
- C9---Fence
- Lakes
- Streams
- Stand Boundary
- Ownership**
 - National Forest
 - Private
- Road System**
 - State Highway
 - County Road
 - Forest Road
 - FS Non-System

0.25 0 0.25 0.5 0.75

County Road-434

County Road-432

State Hwy-BB

1686 (reconstruct)

County Road-

Mark Twain National Forest
Purchase Unit Boundary

Mark Twain National Forest
Purchase Unit Boundary

Mark Twain National Forest
Purchase Unit Boundary

County Road-412

APPENDIX G

Biological Assessment / Biological Evaluation/US Fish and Wildlife Service Consultation

**BIOLOGICAL ASSESSMENT FOR FEDERAL SPECIES
IN THE MIDDLE RIVER PROJECT AREA
U.S.D.A. FOREST SERVICE
MARK TWAIN NATIONAL FOREST
HOUSTON/ROLLA/CEDAR CREEK RANGER
DISTRICT
CALLAWAY COUNTY MISSOURI**

INTRODUCTION

The purpose of this Biological Assessment is to identify the site-specific effects of the proposed action on federal threatened, endangered and proposed species under the Endangered Species Act (ESA). This Biological Assessment (BA) is done to ensure that federally funded actions do not jeopardize listed species or destroy or adversely modify their critical habitat (50CFR 402.12). This BA also utilizes the various species-specific information contained in the September 1998 Mark Twain National Forest Programmatic Biological Assessment (MTNF BA). This BA also documents compliance with the Terms and Conditions of the June 23, 1999 Biological Opinion (BO) on the Impacts of Forest Management and Other Activities to the Gray bat, Bald eagle, Indiana bat on the Mark Twain National Forest.

AREA AFFECTED

Project Location: The Middle River Project Area lies within the 43,374 Acre Middle River (10300102240002) watershed. The Middle River Project Area contains 1,296 acres of Forest Service System lands. It is characterized by broad flat ridge tops, gently rolling topography and some steep bluffs overlooking Middle River itself. It predominately contains hardwoods and numerous openings.

The project is located in Township 46 North, Range 10 West sections 13, 15, 24, 25 and 36, Fifth Principle Meridian in Callaway County Missouri. It is located approximately 5 air miles Southwest of Fulton Missouri.

Management Areas: 3.4.

Project Area Size: 1,296 acres.

LTA's in Project Area: Middle River Breaks portion of the Oak Hickory Hills LTA (HO).

Latitude/Longitude: 38 degrees 45' 57" North and 92 degrees 00' 50" West.

U.S. Geological Survey Quadrangle (Topographic) Map(s): Fulton, Guthrie, Mokane West and New Bloomfield.

PROPOSED ACTION

The preferred alternative is alternative two. The following management actions are listed in the Middle River Environmental Assessment and are given with approximate measures. This alternative would implement land management activities that are consistent with direction in the Mark Twain Land and Resource Management Plan (Forest Plan) and respond to specific needs identified in the Project Area.

A. Wildlife Habitat Enhancement Actions:

1. Reduce Open/Semi-Open Habitat.

Proposed Action A1a: Maintain existing open/semi-open habitat and native ecosystems on 400 acres. These 400 acres would move the area towards the DFC of 10-20 % range outlined in the LRMP. This would be accomplished through prescribed burning and/or grazing, and mechanical treatments in both warm season and cool season grasses. Seeding and fertilizing to maintain these open grazed areas would also continue as needed.

Proposed Action A1b: Plant hardwoods on approximately 45 acres of openlands and reduce prescribed burning on an additional 30 acres of open/semi-open lands to allow these areas to grow into forested habitat. This proposal would reduce the present amount of open/semi-open habitat and move the project area towards the desired future condition.

Provide Woodland Habitat in Old Growth Conditions.

Proposed Action A2: To move this habitat towards the DFC for the project area the proposal is to designate an additional 107 acres of old growth in the Middle River project area. These additional acres with those already designated (83 acres) include a variety of forest types, and block sizes to provide diversity of old growth forest conditions now and in the future. These proposed acres would place the area in the 10-15% range outlined in the LRMP and meet minimum viability.

3. Provide 40-50 percent of the sawtimber component of the Woodland Habitat in Oak, Oak-Pine, and Pine exhibits a condition of 20-30 percent forbs, grass and shrub ground cover.

Proposed Action A3a: To move this habitat towards the DFC for the project area, the proposal is to create approximately 460 acres of 20% to 30% ground cover with forbs, grasses, and shrubs habitat. This would be accomplished with the uneven-aged management technique of individual and group selection harvest in both hardwood and cedar stands. These acres would result in 36% of the Middle River Project Area in the 20 to 30% ground cover by forbs, grasses, and shrubs habitat condition.

Proposed Action A3b: Prescribed burning within 250 acres of woodlands will also contribute to this habitat type.

4. Provide Woodland Habitat in the 0-9 Year Age Class.

Proposed Action A4: To move this habitat towards the DFC for the project area, the proposal is to create 69 acres (15% of the area treated through group selection harvest) of 0-9 age class habitat. This would place the area in the 6% range and meeting minimum viability and moving towards the DFC of 8-15%. (See Action A3a)

5. Provide Diverse Amphibian Habitat.

Proposed Action A5: To help move this habitat toward the DFC and improve amphibian habitat, the proposal is to breach and lower one pond in the project area.

Watershed Health Actions:

1. Fencing to Exclude Livestock.

Proposed Action B1: Currently livestock have access to several wooded areas. Restrict livestock from steeper eroded areas and drainages with fencing.

2. Pond Reconstruction.

Proposed Action B2: Presently one pond is accessible to livestock and therefore does not provide a quality watering source for either cattle or wildlife. Reconstruct this pond in the project area, which would include associated fencing and a cattle watering tank.

3. Reconstruct existing forest road.

Proposed Action B3: Reconstruct Forest Road 1686 (0.9 mile) to improve the present drainage crossing and reduce soil movement. The original scoped proposal stated 0.4 mile, but the actual length of the road is 0.9 mile.

4. Improve Pasture Access.

Proposed Action B4: Improve access through the pastures and protect the soil resources with spot gravel in low or muddy areas in 4 locations

5. Road Closure.

Proposed Action B5: Close approximately 0.4 miles of non-system roads through the use of boulders and/or gates.

6. Planting/watershed control structure.

Proposed Action B6: Reduce soil movement at three wooded draws by planting and/or seeding native vegetation or installing a watershed control structure.

7. Well Closure.

Proposed Action B7: Close 2 existing open wells to improve safety to area users and protect soil resources.

8. Pond Maintenance.

Proposed Action B8: Maintain existing ponds as needed with methods such as mowing pond banks to control vegetation, fencing, or replacement of livestock watering tanks.

C: Recreation Management Needs

1. Improve parking lots.

Proposed Action C1: Improve five parking lots with gravel.

2. Interpretive signing

Proposed Action C2: Construct interpretive signs for the cultural history.

3. Self closing gate

Proposed Action C3: Improve dispersed access for fishing by installing a self-closing gate.

D: Associated or Connected Actions

Proposed Action D1. Some prescribed burn areas may need fireline construction. Natural firebreaks will be utilized wherever necessary. Construct approximately 1 mile of mechanical firelines.

Proposed Action D2. Reduce the spread and infestation of non-native invasive and noxious weeds such as multi-flora rose and/or sericea lespedeza (*Lespedeza cuneata*). Spot treat individual invasive plants with herbicide on 59 acres. *(Note: the individual plants would be treated by hand application only. Aerial and/or tractor boom application would not be utilized)*

Proposed Action D3. Improve hardwood seedling survival. Where hardwood plantings are proposed (See Proposed Action A1b), there is a need to improve seedling survival. Previous hardwood plantings into grasses such as fescue have greatly reduced survival and growth of planted trees. Spot treat seedling planting sites with herbicide within 45 acres to improve survival. *(Note: individual planting sites would be treated by hand application only.)*

CONSULTATION HISTORY

In 1984, the Forest Service requested formal consultation with the US Fish and Wildlife Service (FWS) on the Mark Twain National Forest Land and Resource Management Plan (Forest Plan). On August 8, 1985 FWS issued a non-jeopardy

biological opinion for seven federal species. In 1998, the Forest Service reinitiated programmatic consultation for continued implementation of the Forest Plan. Further consultation was needed to incorporate information gathered about federally threatened and endangered species over the past decade. The Mark Twain National Forest prepared a programmatic Biological Assessment (MTNF BA) that included the following federal species: bald eagle (*Haliaeetus leucocephalus*), gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), Mead's milkweed (*Asclepias meadii*), running buffalo clover (*Trifolium stoloniferum*), Tumbling Creek cavesnail (*Antrobia culveri*) a current candidate species at that time, Topeka shiner (*Notropis topeka*), Curtis pearly mussel (*Epioblasma curtisi*), pink mucket pearly mussel (*Lampsilis abrupta*), Hall's bulrush (*Schoenoplectus hallii*) a current candidate species was submitted to FWS in September 1998. *Note: The Hall's bulrush also is a Regional Forester Sensitive Species (RFSS). Information can be found in the RFSS Biological Evaluation.*

Determinations of no effect or not likely to adversely affect were made for six of the ten species including Running buffalo clover, Tumbling Creek cave snail, Topeka shiner, Curtis pearly mussel, Pink mucket pearly mussel, Hall's bulrush. These determinations were concurred with by FWS during informal consultation. On June 23, 1999 FWS issued a non-jeopardy Biological Opinion (BO) for Bald eagle, Gray bat, Indiana bat and Mead's milkweed.

On August 18 and September 12, 2003 Klaus Leidenfrost discussed the proposed Middle River Project with Theresa Davidson (FWS). The species discussed include the Bald eagle, Gray bat, Indiana bat, Topeka shiner and Running Buffalo clover.

CRITICAL HABITAT

There is no designated critical habitat on the Mark Twain National Forest for any Federal threatened and endangered Species.

SPECIES CONSIDERED

The July 31, 2002 species list from the U.S. Fish and Wildlife Service was utilized for the preparation of this Biological Evaluation. It includes the Gray bat, Indiana bat, Bald Eagle, Topeka shiner, Curtis pearly mussel, Pink mucket pearly mussel, Scale shell mussel, Hine's emerald dragonfly, Running buffalo clover, Tumbling Creek Cavesnail and the Mead's milkweed.

The Curtis pearly mussel, Pink mucket pearly mussel, Hine's emerald dragonfly, Scaleshell mussel, Mead's milkweed and Tumbling Creek cave snail do not exist in or have potential habitat on Cedar Creek portion of Houston/Rolla/Cedar Creek Ranger District or in the Middle River Project Area.

Curtis' pearly mussel (*Epioblasma florentia*): This mussel occurs on river bottoms consisting of various materials from sand to boulders. However, this species needs flowing water for spawning. Middle River drains into the Missouri River. This species is found in the Black and Current River systems that drain into the Mississippi River downstream from its junction with the Missouri River

Pink mucket pearly mussel (*Lampsilis abrupta*): This mussel occurs on unconsolidated bottoms consisting of mud and/or sand and/or gravel. However, this species needs flowing water for spawning. It lives in sixth and seventh order streams (which are larger than Middle River). Historically, this species occurred in the Gasconade River system, but it is now extirpated from that system. It is found in areas with a low to moderate turbidity. The Zebra mussel is also impacting this species.

Scaleshell mussel (*Leptodea leptodon*): This relatively small mussel is often found in riffles in clear unpolluted water with a good current and is very susceptible to high sediment levels and other forms of water pollution. This species is known to occur in the Gasconade River system. The Middle River Project Area does not drain into the Gasconade River system.

Hine's emerald dragonfly (*Somatachlora hineana*): Is found in fens and/or wetlands with a high calcium carbonate level. No fens are found in the Middle River area. The nearest documented sightings are in a large fen over 60 air miles to the south.

Mead's Milkweed (*Asclepias meadii*): The only place on the Mark Twain National Forest where this glade dependant species is located is in the Bell Mountain Wilderness which is located over 50 air miles to the South.

Tumbling Creek cave snail (*Antrobia culveri*): This species is only known to occur in the Tumbling Creek Cave which is located over 100 air miles to the South on non Forest Service System lands.

Note: Because these species do not exist in, or have potential habitat in the Middle River area, they will not be evaluated any further in this document. A "No Effect" (NE) determination applies to all these species.

SPECIES EVALUATED

Only the **Bald Eagle, Gray bat, Indiana bat, Topeka shiner and the Running buffalo clover**, have potential habitat on the Cedar Creek portion of Houston/Rolla Ranger District or may occur in the Middle River Project Area. Therefore, only these will be fully evaluated.

A. BALD EAGLE – *Haliaeetus leucocephalus*

Species and habitat Information: The bald eagle is associated with aquatic environments (usually larger bodies of water such as lakes and large Rivers) throughout the majority of its range but will utilize upland areas when water is frozen. Fish is the primary prey item. They will also feed on other types of prey such as waterfowl, small mammals and have been observed feeding on carrion such as deer, especially in wintering areas. In Missouri, Bald eagles are usually present from November – March.

Nesting activities may begin as early as January with incubation and rearing of young occurring from March through mid-May. Nesting sites are usually in mature trees along shorelines, but they may use cliffs or rock outcrops where large trees are not available. Bald eagles generally utilize larger heavy branched trees within 100-600 feet of water for perch and/or roost sites. In Missouri most young fledge from June 1 to mid-July.

The previous use of DDT in the United States had a negative effect on the thickness of Bald eagle eggs and therefore their reproductive success. However the use of DDT has been banned for over a quarter of a century in the United States.

Since the Bald eagle was listed in 1978, populations have clearly increased in number and expanded in range throughout the United States. (Refer to pages 121 - 138 of the bald eagle section of the MTNF BA and pages 26-35 of the BO for additional information).

Survey Information:

Information from the Missouri Department of Conservation's Heritage Database was utilized in the preparation of this section.

The Mark Twain National Forest participates in Annual bald eagle winter counts. Information on the bald eagle's status and distribution in Missouri is found on pages 28 – 33 of the BO.

There are no documented active bald eagle nests on the Cedar Creek portion of the Mark Twain National Forest. No Bald eagles have been observed in the Middle River Project Area.

The Middle River project is located:

- Approximately 40 air miles Southeast from the nearest documented active nest site (This site is not located on National Forest System Lands).
- Approximately 70 air miles west of the nearest known communal roost.

Effects on the Bald eagle

Direct and Indirect Effects: No Bald eagles are known to occur in the Middle River Project Area. There are no large bodies of water in the Middle River Project Area which would attract Bald eagles. However, it is possible that they may pass through the area. Smoke from prescribed burns and other activities associated with implementing the Middle River project could result in the temporary displacement of individual birds.

Implementation of the Middle River project would not remove or kill any of the large potential perch and/or roost and/or nest trees preferred by the bald eagle in areas adjacent to Middle River. Watershed improvement projects would benefit the fish species in the area. The maintenance of openings would benefit the smaller mammals and ungulates that the Bald eagle also feeds on.

Herbicide use: *Note: Some limited use of herbicide is planned. All application rates and methods would follow the manufacturers and EPA guidelines.*

Page 125 and 126 of the Bald eagle section of the September 1998 Biological Assessment identify herbicide use and any effects on the Bald eagle.

Some limited application of Glyphosate (Roundup, Rodeo and Accord) would occur on the non-native Multi-flora Rose, which is a state listed noxious weed. Some limited application of Triclopyr (Garlon 3A and 4) would occur on approximately 60 acres to control *Serecia lespedeza*, which is a non-native invasive species.

In addition Glyphosphate would also be used to spot treat approximately 10 acres of old fescue fields. This would increase the hardwood seedlings survival in the thick fescue mat. All the applications would involve spot treatments only, there would be no aerial spraying.

Page 6 in the Introduction of the MTNF BA mentions the use of Glyphosate to help control noxious weeds. Glyphosate is a Foliar systemic herbicide (where the herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms.

Glyphosphate would also be used to spot treat approximately acres of Fescue (a non native invasive species) to increase the success of native hardwood plantings.

Triclopyr is a very species specific and effects the growth hormones and causes uncontrolled growth in plants. At sufficient levels, the abnormal growth is so severe that vital functions cannot be maintained and the plant dies.

According to page 4-1 of the Triclopyr Risk Assessment “At application rates that are equal to or greater than those contemplated by the Forest Service, these studies suggest that effect on animal populations will be secondary to changes in vegetation and food supply and that these will either have no effect or will be beneficial to birds as well as mammals.”

According to page 4-24 and 4-25 of the Triclopyr Risk Assessment “At plausible levels of acute exposure in standing water and streams, 0.07-0.5 mg/L, Garlon 3A is not likely to have any effect on fish and aquatic invertebrates, and most algae. Some sensitive macrophytes could be affected. Currently information is only available on the Eurasian watermilfoil. This species is adversely affected if water concentrations remain above 0.25 ml/L for more than 24 hours. Such concentrations are not plausible in streams but could be maintained in small standing bodies of water.” There would be no effect on invertebrate abundance. *Note: No application of Triclopyr would occur over live or standing water.*

Page 126 and page 134 of the Bald eagle section in the September 1998 Biological Assessment state, that the ongoing activities with no effect include pesticide use (since no DDT is being utilized).

Page 13 of the BO states that on the Mark Twain National Forest “Herbicide use is restricted to noxious weed control, conversion of non-native fescue grass to native...”. Page 13, also states that “Glyphosate (Roundup, Rodeo, Accord) is used around buildings, for noxious weed control, ...”

Note: The Forest Plan BO does not identify or recognize herbicide use as having any direct or indirect effects on the Bald eagle.

Therefore, herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Page 126 - 134 of the Bald eagle section of the September 1998 Biological Assessment identifies numerous types of activities that may have an effect on the Bald eagle (these are summarized on page 134). There are several categories of projects identified in Purpose and Need of the Middle River project that may have an Adverse Effect on the Bald eagle. These include Prescribed fire (Page 130, 132, Timber harvest and/or Tree removal (Page 126 - 130 and 133) and Road maintenance/Road /reconstruction (page 130-131).

1) Prescribed fire: Approximately 650 acres would be treated with prescribed fire to help maintain natural openings and enhance the ecosystem. Maintaining openings with prescribed fire would benefit the bald eagles alternative prey base. A Bald eagle may pass thru the area, therefore there is the possibility that smoke from a prescribed fires could result in Bald eagles temporarily leaving the area. Bald Eagles have been

observed staying on their nest during a prescribed burn (Personnel communication with Theresa Davidson 2003).

The effects of burning would be short lived and temporary for the following reasons: (1) Smoke dispersal would occur within 24 hours (may be as few as several hours in some cases) and (2) Burning has occurred in Missouri for centuries, this species has evolved with burning. The expected fire intensity is low enough that no potential roost and/or perch trees would be removed or damaged.

Prescribed fire would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

2) Timber harvest and/or Tree removal: No existing potential perch trees or roost trees adjacent to Middle River would need to be removed. Over 90 percent of the Middle River corridor occurs on private lands.

There would be approximately 450 acres of timber removal in the Middle River area. The harvest method is uneven-age management (group selections) *Note: None of these activities would occur in the Forested Riparian corridor along the Middle River where any potential perch and/or roost and/or nest trees would likely occur.*

No timber harvest or tree removal would occur on approximately 200 acres that would be designated as Old Growth areas in the Middle River project.

Timber Harvest would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion

3) Road maintenance/reconstruction: The maintenance of existing Forest Service system roads would occur. This would have a positive benefit for the areas watershed and fisheries (the Bald eagles primary food source) as compared to no road maintenance. The existing unimproved live water crossing on Forest Road 1686 would be improved, so that sediment would no longer enter the stream after each vehicle crossing.

Road maintenance/reconstruction would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment.

ESA Cumulative Effects (50 CFR 402.02)

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

This includes fire suppression, prescribed fire, wildfire, various recreational activities, timber harvest, timber stand improvement, livestock grazing, farming operations, wildlife and fish habitat improvements, road construction and reconstruction and road closures. It also includes land clearing for farms and/or home sites and the use of chemicals.

Findings of MTNF BA / BO compliance

Effects of project activities have been determined by this analysis to be the same or less than the effects described in the MTNF BA (pg. 121 - 138) and BO (pg. 33 - 36). The MTNF BA project categories that may have a potential adverse effect are discussed in the Direct and Indirect effects section. There are no activities proposed in the Middle River Project that were not identified and/or discussed in the MTNF BA and BO. All the Reasonable and Prudent Measures (RPM) with their associated Terms and Conditions (TC) and the Conservation recommendations (CM) outlined (pg. 37 - 39) in the June 23, 1999 FWS Biological Opinion are being met.

Because all Middle River activities will comply with RPM's and TC's of the 6-23-99 BO, there will be no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Additional Resource Protection Measures

No additional Resource Protection Measures beyond the RPM/TC (BO page 37 - 39) are required to meet the Forest Plan and/or the BA/BO.

Conclusion/Determination:

The potential habitat for the Bald eagle would be maintained and/or improved as a result of the following activities.

(1) Implementation of the Middle River project would not remove or kill any of the potential large perch and/or roost and/or nest trees preferred by the bald eagle in areas adjacent to Middle River.

(2) Watershed improvement projects such as those identified below would benefit the fish species and riparian resource in the area.

A). Improving the existing live water stream crossing on Forest Road 1686 in order to reduce the amount of sediment entering the stream.

B.) Watershed and riparian area enhancements such as planting hardwoods (which would help to provide additional shade along the Middle River) would occur.

(3) The maintenance of openings would benefit the smaller mammals and ungulates that the bald eagle also feeds on.

(4) If a prescribed burn is occurring and a bald eagle passes thru the area, it could keep on moving.

The Bald eagle is not known to occur in the Middle River area. However, it may pass thru the Middle River area. None of the proposed projects actions would effect any potential Bald eagle habitat. **There is a “No Effect” (NE) determination for the Bald eagle and the Middle River project.**

B. GRAY BAT – *Myotis grisescens*

Species and habitat Information:

This medium size bat has grayish-brown fur. The gray bat's range is limited to the limestone karst areas of the southeastern and central United States.

The gray bat is primarily restricted to cave habitats and will rarely use other habitats. This species has very specific cave requirements; as a result, less than five percent of available caves are utilized. These requirements vary depending on time of year, age, and sex. Summer caves must be warm (55°-77° F), or with restricted rooms that can trap the body heat of roosting bats, and winter caves are very cold with a range in temperature between 42° and 52° F. These caves are deep with vertical walls and act as cold air traps. During transient period, gray bats may use transient caves that have less restrictive requirements than the summer and winter caves. In addition, males and yearling females will use a wider variety of caves and roost sites throughout the year. Summer caves are typically within 0.6 miles, rarely over 2.4 miles, of rivers and reservoirs that they forage over. Gray bats foraging areas are usually within 7 miles of their cave, but may forage up to 12 miles away where they feed on emergent aquatic insects. They have been known to travel nearly 30 miles in some instances (Personnel communication with Sybill Amelon. 2003)

Chlorinated hydrocarbon pesticides are a known factor in the decline of Gray bat populations. However, these pesticides have been banned since the late 1970's.

Gray bats breed at hibernation caves during September and October. Females will store the sperm over the winter and become pregnant after emerging in late March. A single offspring is born in late May or early June. *Note: Over 90 percent of the Gray bat caves in Missouri are not found on the Mark Twain National Forest.* (Refer to pages 141 - 159 of the Gray bat section of the MTNF BA and pages 16-20 of the BO for additional information on the Gray bat).

Survey Information:

Cave Research Foundation, Missouri Department of Conservation surveys and Forest Service surveys have been conducted across the forest and adjoining areas in the state of Missouri.

The Forest has conducted spring-fall mist netting at several locations during 1997, 1998, 1999, 2001 and 2002. Several Gray bats were captured in the Middle River Project Area along Middle River itself, during surveys conducted in 2003. One Gray bat was outfitted with a radio transmitter. The bat was tracked for 3 nights. It was only found on Forest Service lands during the first night (Personnel Communication with Sybill Amelon 2003).

The nearest known Gray bat cave is located immediately approximately 15 air miles west of the Middle River Project Area. Over 90 percent of the Gray bat caves in Missouri are not found on the Mark Twain National Forest.

The Missouri Heritage Database contains information on specific locations for threatened and endangered species, as well as common species. This information is compiled from field surveys and research conducted by the Missouri Department of Conservation, U.S. Forest Service, and other agencies. This database is continually being updated by the Missouri Department of Conservation. The information is summarized in the Geographical Information System (GIS) format. Information on the gray bat status and distribution in Missouri is found on pages 19 – 20 of the BO.

The Middle River project is located:

- Approximately 15 air miles west of the nearest known gray bat cave.

Effects on the Gray bat

Direct and Indirect Effects: One Gray bat was found in the Middle River project area in 2003. None of the proposed Middle River project would remove any trees in Riparian areas. Approximately 8 acres of hardwoods would be planted in riparian areas. Other Watershed improvement projects such as road closures of temporary and non-system roads, reducing erosion at an existing stream crossing and installing a erosion control structure would also occur. These projects would reduce sedimentation in the long term and improve the riparian habitat. Because Gray bats utilize Riparian corridors, these watershed type projects would benefit Gray bats. The intensity of the prescribed fires burn would be minimal, and thereby maintain any existing Gray bat habitat.

Herbicide use: Some limited use of herbicide is planned.

Note: All application rates and methods would follow the manufacturers and EPA guidelines. None of the Herbicides to be used contain DDE or heptachlor

compounds which have been implicated in the decline of Gray bats (MTNF BA pg. 147).

Some limited application of Glyphosate (Roundup, Rodeo and Accord) would occur on the non-native Multi-flora Rose, which is a state listed noxious weed. Some limited application of Triclopyr (Garlon 3A and 4) would occur on approximately 60 acres to control Serecia lespedeza, which is a non-native invasive species.

In addition Glyphosphate would also be used to spot treat approximately 10 acres of old fescue fields. This would increase the hardwood seedlings survival in the thick fescue mat. All the applications would involve spot treatments only, there would be no aerial spraying.

Page 6 in the Introduction of the MTNF BA mentions the use of Glyphosate to help control noxious weeds. Glyphosate is a Foliar systemic herbicide (where the herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms.

Glyphosphate would also be used to spot treat approximately 40 acres of Fescue (a non native invasive species) to increase the success of native hardwood plantings.

Triclopyr is a very species specific and effects the growth hormones and causes uncontrolled growth in plants. At sufficient levels, the abnormal growth is so severe that vital functions cannot be maintained and the plant dies.

According to page 4-1 of the Triclopyr Risk Assessment "At application rates that are equal to or greater then those contemplated by the Forest Service, these studies suggest that effect on animal populations will be secondary to changes in vegetation and food supply and that these will either have no effect or will be beneficial to birds as well as mammals."

According to page 4-24 and 4-25 of the Triclopyr Risk Assessment "At plausible levels of acute exposure in standing water and streams, 0.07-0.5 mg/L, Garlon 3A is not likely to have any effect on fish and aquatic invertebrates, and most algae. Some sensitive macrophytes could be affected. Currently information is only available on the Eurasian watermilfoil. This species is adversely affected if water concentrations remain above 0.25 ml/L for more than 24 hours. Such concentrations are not plausible in streams but could be maintained in small standing bodies of water." There would be no effect on invertebrate abundance. *Note: No application of Triclopyr would occur over live or standing water.*

Page 146 in the Grey bat section in the September 1998 Biological Assessment state, that the ongoing activities with no impact include pesticide use.

Page 13 of the BO states that on the Mark Twain National Forest “Herbicide use is restricted to noxious weed control, conversion of non-native fescue grass to native...”. Page 13, also states that “Glyphosate (Roundup, Rodeo, Accord) is used around buildings, for noxious weed control, ...”

The BO does not identify or recognize herbicide use as having any direct or indirect effects on the Bald eagle.

Therefore, herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

The BO does not identify or recognize herbicide use as having any direct or indirect effects on the Gray bat.

Therefore, herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Page 5 - 15 of the Gray bat section of the September 1998 Biological Assessment identifies numerous types of activities that may have a beneficial and/or adverse effect on the Gray bat (these are summarized on page 155). There are several categories of projects identified in Purpose and Need of the Middle River project that may have an Adverse Effect on the Gray bat. These include Prescribed fire (Page 152 - 153), Timber harvest and/or Tree removal (Page 148, 150 - 152), and Road maintenance/Road reconstruction (page 150 - 152).

1) Prescribed fire: Approximately 650 acres would be treated with prescribed fire to help maintain natural openings and savannas and enhance the ecosystem. Gray bats are not known to occur in the Middle River area. However, smoke from prescribed fires could result in Gray bats temporarily leaving the area. The expected fire intensity is low enough that existing water quality and riparian habitat would be retained.

The effects of burning would be short lived and temporary for the following reasons: (1) Smoke dispersal would occur within 24 hours (may be as few as several hours in some cases) and (2) Burning has occurred in Missouri for centuries, this species has evolved with burning.

Prescribed fire would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

2) Timber harvest and/or Tree removal: There would be approximately 450 acres of timber removal in the Middle River area. The harvest method is uneven-age management (group selections)

None of these activities would occur in the Forested Riparian corridor along the Middle River. No timber harvest or tree removal would occur on approximately 200 acres that would be designated as Old Growth areas in the Middle River project.

Timber Harvest would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion

3) Road maintenance/reconstruction: The maintenance of existing Forest Service system roads would occur. This would have a positive benefit for the areas watershed and fisheries as compared to no road maintenance. The existing unimproved live water crossing on Forest Road 1686 would be improved, so that sediment would no longer enter the stream after each vehicle crossing.

Road maintenance/reconstruction would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment.

ESA Cumulative Effects (50 CFR 402.02)

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River Project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

This includes fire suppression, prescribed fire, wildfire, various recreational activities, timber harvest, timber stand improvement, livestock grazing, wildlife and fish habitat improvements, road construction and reconstruction and road closures on private lands. It also includes land clearing for farms and/or home sites and housing construction and the use of chemicals on private land.

Findings of MTNF BA / BO compliance

Effects of project activities have been determined by this analysis to be the same or less than the effects described in the MTNF BA and BO. In addition there are no activities proposed in the Middle River Project that were not identified and/or discussed in the MTNF BA and BO. All the Reasonable and Prudent Measures (RPM) with their associated Terms and Conditions (TC) and the Conservation recommendations (CM) outlined (page 23 – 25) in the June 23, 1999 FWS Biological Opinion are being met. *See the Direct and Indirect section above for additional information.*

Because the Middle River Project activities will comply with RPM's and TC's of the 6-23-99 BO, there will be no additional effects beyond those previously

disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Additional Resource Protection Measures

No additional Resource Protection Measures beyond the RPM/TC (BO page 23 - 25) are required to meet the Forest Plan and/or the MTNF BA/BO.

Conclusion/Determination:

The habitat for the Gray bat would be maintained and/or improved as a result of the following activities.

(1) Watershed improvement projects such as closing and revegetating some native surface roads that currently are sediment producers would reduce sedimentation in the area.

(2) Riparian area enhancements such as planting hardwoods, would help to maintain the riparian corridors that this species utilizes.

Overall any negative effects would be short lived and temporary. However, the long-term riparian habitat in the Middle River project would be improved. In addition there would be a reduction in sediment production in the area.

The Gray bat is known to occur in the Middle River Project Area. However, there are no known Gray bat caves within the Middle River Project Area. No timber harvest would occur in any Riparian areas. The long-term water quality and riparian habitat in the Middle River Project Area would be improved as a result of implementing the watershed improvement projects in this proposal. Overall any potential negative effects would be short lived and temporary.

Therefore there is a May Affect - Not Likely to Adversely Affect (NLAA) determination for the Gray bat and the Middle River project.

C. INDIANA BAT – *Myotis sodalis*

The Indiana bat is a medium size bat with a total length of 3 to 4 inches and a wingspan of 9.5 to 10.5 inches. The Indiana bat is found throughout the eastern half of the United States. In portions of their range in the United States, the Indiana bat populations have declined steadily and drastically since the 1980's. Indiana bats hibernate in caves and mines during the winter. These sites tend to have temperatures between 39° and 46° F and relative humidity above 74% and below saturation.

Summer habitats for Indiana bat are floodplain, riparian, and upland forest with trees that have ex-foliating bark for roosting. The Indiana bat will also use old fields and pastures with scattered trees for foraging habitats.

During the winter months Indiana bats hibernate in caves and abandoned mines. During the summer months Indiana bats are found predominately in forested areas near water. Female Indiana bats crawl under the peeling bark of large trees to have their young. Maternity roost sites are usually located in areas with 60 to 80% canopy cover (1999 U.S Fish Wildlife Service Biological Opinion 1999, page 42). Indiana bats forage in and around the tree canopy for flying insects. A 50-70% canopy closure is ideal for Indiana Bat foraging (MTNF BA, page 177). This is because the bats can move easier between the trees and that there is a greater habitat diversity compared to a mature canopy and therefore a greater abundance of insects.

Indiana bats have been declining recently due to human disturbance at their hibernating sites, loss of large trees with peeling bark that provide roosting sites, pesticide use and their naturally low birth rate. Indiana Bats utilize flood plains and riparian forests during the summer. Primary roosts are located in openings or the edge of forest stands (1999, U.S. Fish & Wildlife Service Biological Opinion for the Mark Twain National Forest).

The Indiana bat will use various tree species for roosting. Many trees don't have the proper characteristics for roost sites until they are dead or dying. However, species such as shagbark hickory and white oak are used while they are still living. Maternity roost sites are usually located in areas with 60 to 80% canopy cover.

Indiana bats forage in and around the tree canopy for flying insects. During the summer months, male Indiana bats normally forage within 1.2 miles of their hibernacula and during the fall this can increase to 1.8 to 4.2 miles.

Indiana bat's begin to swarm in August-September, and breeding usually occurs in the latter half of this time period. Females become pregnant after emerging the following spring. The young are born in late June or early July.

Refer to pages 161 - 166 of the Indiana bat section of the MTNF BA and pages 40 - 72 of the BO for additional information on the Indiana bat.

Survey Information:

Cave Research Foundation, Missouri Department of Conservation surveys and Forest Service surveys have been conducted across the forest and adjoining areas in the state of Missouri.

The Missouri Heritage Database contains information on specific locations for Threatened and Endangered species as well as common species. This information is

compiled from field surveys and research conducted by the Missouri Department of Conservation, U.S. Forest Service, and other agencies. This database is continually being updated by the Missouri Department of Conservation. The information is summarized in the Geographical Information System (GIS) format.

The Forest has conducted spring-fall mist netting at several locations during 1997, 1998, 1999, 2001 and 2002. No Indiana bats were caught in any of the above mist nettings. There are no documented Indiana bat sightings in the Middle River area. No Indiana bats were found during the 2003 bat surveys conducted in the Middle River Project Area (Personnel Communication with Sybill Amelon 2003).

Additional information on the Indiana bat status and distribution in Missouri is found on pages 161 - 164 of the MTNF BA and pages 48 – 62 of the BO.

The Middle River project is located:

- There are two caves documented to have Indiana bats over 14 air miles south and east of the Middle River Project Area. These caves do not occur on National Forest System lands.
- Approximately 70 air miles north west of the nearest capture site of a reproductive female Indiana bats. This capture site is located on lands owned by the State of Missouri.
- Approximately 70 air miles north of the nearest maternity colony.

Effects on the Indiana bat

Direct and Indirect Effects: There are no known Indian bat hibernacula in the Middle River Project Area. In addition the Middle River project would maintain roost trees, foraging habitat and potential fall swarming habitat.

The long-term indirect effect is that many of the existing White oak and Shagbark hickories (potential roost trees) would have increased growth rates because there would be less competition for light, water and nutrients from the surrounding trees. However, some potential roost trees may be lost as a result of logging. Uneven aged management would reduce the existing dense canopy closure and move it toward the 50-70% canopy closure that is ideal for Indiana Bat foraging. This benefit would diminish once those canopies grow together and the canopy closure again exceeds 70%.

The Middle River area is to be burned when the prevailing winds would not blow smoke (may result in the temporary displacement of individuals) west towards the nearest known Indiana bat caves. These effects would be short lived and temporary for the following reasons: (1) Smoke dispersal would occur within 24 hours (may be as few as several hours in some cases), and (2) Since burning has occurred in the Ozarks for centuries, this species has evolved with burning.

The intensity of the burn would be minimal. Therefore, no suitable roost trees are expected to be removed by fire. It is possible that some snags with slouching bark (potential roost trees) could be created. Burning may also reduce some of the dense understory in the area, which can inhibit movements by bats.

According to the FWS, the Indiana bat would benefit from prescribed burning. "...prescribed fires will provide some beneficial effects to the species by opening closed forest canopies, and by decreasing dense under story vegetation that can inhibit movements..." (pg. 63 of the June 23, 1999 FWS Biological Opinion).

Herbicide use: *Note: Some limited use of herbicide is planned. All application rates and methods would follow the manufacturers and EPA guidelines.*

Some limited application of Glyphosate (Roundup, Rodeo and Accord) would occur on the non-native Multi-flora Rose, which is a state listed noxious weed. Some limited application of Triclopyr (Garlon 3A and 4) would occur on approximately 60 acres to control *Serecia lespedeza*, which is a non-native invasive species.

In addition Glyphosphate would also be used to spot treat approximately 10 acres of old fescue fields. This would increase the hardwood seedlings survival in the thick fescue mat. All the applications would involve spot treatments only, there would be no aerial spraying.

In addition the proposed application of Glyphosate would meet the guidelines regarding the applications of pesticides and Indiana bat caves (LRMP IV – 51 and 52). Glyphosate is a Foliar systemic herbicide (where the herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms

Page 6 in the Introduction of the MTNF BA mentions the use of Glyphosate to help control noxious weeds. Glyphosate is a Foliar systemic herbicide (where the herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms.

Triclopyr is a very species specific and effects the growth hormones and causes uncontrolled growth in plants. At sufficient levels, the abnormal growth is so severe that vital functions cannot be maintained and the plant dies.

According to page 4-1 of the Triclopyr Risk Assessment "At application rates that are equal to or greater then those contemplated by the Forest Service, these studies suggest that effect on animal populations will be secondary to changes in vegetation

and food supply and that these will either have no effect or will be beneficial to birds as well as mammals.”

According to page 4-24 and 4-25 of the Triclopyr Risk Assessment “At plausible levels of acute exposure in standing water and streams, 0.07-0.5 mg/L, Garlon 3A is not likely to have any effect on fish and aquatic invertebrates, and most algae. Some sensitive macrophytes could be affected. Currently information is only available on the Eurasian watermilfoil. This species is adversely affected if water concentrations remain above 0.25 ml/L for more than 24 hours. Such concentrations are not plausible in streams but could be maintained in small standing bodies of water.” There would be no effect on invertebrate abundance. *Note: No application of Triclopyr would occur over live or standing water.*

Page 185, 188 and 191 of the Indiana bat section of the September 1998 Biological Assessment state that the ongoing activities with no effect include pesticide use.

Page 188 of the Indiana bat section of the September 1998 Biological Assessment states “None of the pesticides implicated in bat declines would be used on the Mark Twain National Forest.”

Page 13 of the BO states that on the Mark Twain National Forest “Herbicide use is restricted to noxious weed control, conversion of non-native fescue grass to native...”. Page 13 also states that “Glyphosate (Roundup, Rodeo, Accord) is used around buildings, for noxious weed control, ...”

The BO does not identify or recognize any herbicide that could be used on the Mark Twain National Forest as having any direct effect on the Indiana bat (BO page 65).

Therefore, herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Page 179 - 194 of the Indiana Bat section of the September 1998 Biological Assessment identifies numerous types of activities that may have a beneficial and/or adverse effect on the Indiana bat (these are summarized on page 191). There are several categories of projects identified in Purpose and Need of the Middle River project that may have an Adverse Effect on the Indiana bat. These include Prescribed fire (Page 189, 191) and, Timber harvest and/or Tree removal (Page 179 - 180, 190).

1) Prescribed fire: Approximately 650 acres would be treated with prescribed fire to help maintain natural openings and enhance the ecosystem. However, smoke from prescribed fires could result in Indiana bats temporarily leaving the area (see the Resource Protection Measures below, which address this concern). Because the expected fire intensity would be minimal, no suitable roost trees would be removed by fire. It is possible that some snags with sloughing bark (potential roost trees) would be created. Prescribed fire would also help reduce the dense understory vegetation that can inhibit movements by bats.

According to the FWS, the Indiana bat would benefit from prescribed burning. "... prescribed fires will provide some beneficial effects to the species by opening closed forest canopies, and by decreasing dense under story vegetation that can inhibit movements..." (pg. 63 of the June 23, 1999 FWS Biological Opinion).

Prescribed fire would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

2) Timber harvest and/or Tree removal: The Middle River project is over 10 air miles from the nearest known Indiana Bat Cave. There is a very slight potential that Indiana bats may occasionally utilize the area.

There would be approximately 450 acres of timber removal in the Middle River area. The harvest method is uneven-age management (group selections). These various treatments would result in a mosaic of different habitats. However, there is a possibility that some potential roost trees may be removed. In some locations timber removal would help reduce the existing dense canopy that can inhibit bat movements. "...that most roosts were located in areas that had a canopy closure of 60 to 80." (pg. 42 of the June 23, 1999 FWS Biological Opinion).

No timber harvest or tree removal would occur on approximately 200 acres that would be designated as Old Growth areas in the Middle River project. None of these activities would occur in the Forested Riparian corridor along the Middle River.

Timber Harvest would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

ESA Cumulative Effects (50 CFR 402.02):

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

This includes fire suppression, prescribed fire, wildfire, various recreational activities, timber harvest, timber stand improvement, livestock grazing, wildlife and fish habitat improvements, road construction and reconstruction and road closures on private lands. It also includes land clearing for farms and/or home sites and housing construction and the use of chemicals on private land.

Findings of MTNF BA / BO compliance

Effects of project activities have been determined by this analysis to be the same or less than the effects described in the MTNF BA and BO. In addition there are no activities proposed in the Middle River Project that were not identified and/or discussed in the MTNF BA and BO. All the Reasonable and Prudent Measures (RPM) with their associated Terms and Conditions (TC) and the Conservation recommendations (CM) outlined (pg. 75 - 82) in the June 23, 1999 FWS Biological Opinion are being met. This includes the TC which were developed specifically for the Cedar Creek Ranger District (BO pg. 78) *See the Direct and Indirect section above for additional information.*

Because the Middle River Project activities will comply with RPM's and TC's of the 6-23-99 BO, there will be no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment and Biological Opinion.

Additional Resource Protection Measures

No additional Resource Protection Measures beyond the RPM/TC (BO page 76 - 81) are required to meet the Forest Plan and/or the MTNF BA/BO.

Conclusion/Determination:

The habitat for the Indiana bat would be maintained and/or improved as a result of the following activities which would retain at least 23 roost trees per acre.

- 1) Implementation of the Middle River project would not remove any live potential roost trees $\geq 26''$ dbh. Unless they are an immediate safety hazard *
- 2) Implementation of the Middle River project would not remove any dead potential roost trees $\geq 20''$ dbh. Unless they are an immediate safety hazard *
- 3) Implementation of the Middle River project would retain all the shagbark hickory, shellbark hickory, and lightning struck trees $\geq 9''$ dbh within harvest units. It would also retain some (not all) dead and dying trees $\geq 9''$ dbh with at least 10% exfoliating or defoliating bark within harvest units. *
- 4) Approximately 200 acres of Old Growth areas would be designated in the Middle River project. *
- 5) Prescribed burning and/or Uneven aged silvicultural treatments would help to provide the 60 – 80 % canopy closure for ideal roosting sites.
- 6) Prescribed burning and/or Uneven aged silvicultural treatments would help to reduce the dense canopies in areas thereby allowing for better movement of Indian bats in the area.

7) Watershed and riparian area enhancements such as planting hardwoods and reconstructing the existing unimproved live water crossing on Forest Road 1686 would improve the water quality in the Middle River area. Thereby benefiting potential Indiana bat habitat.

* These would provide and retain potential Indiana bat roost sites

Note: The FWS would have the opportunity to review the Burn Plans 30 days prior to any planned ignition if they desire.

The Indiana bat is not known to occur in the Middle River Project Area. In addition the Middle River Project activities will comply with RPM's and TC's of the 6-23-99 BO. All proposed activities would maintain and/or improve any potential Indiana bat habitat. **Therefore there is a May Affect - Not Likely to Adversely Affect (NLAA) determination for the Indiana bat and the Middle River project.**

D. Topeka shiner – *Notropis Topeka*

Species and habitat Information:

The Topeka shiner prefers undisturbed small prairie headwater streams. The adults are usually under 3 inches long. It can tolerate a wide range of temperature fluctuations (near freezing to 90 degree Fahrenheit). It breeds from May to mid-July. However, it has been found in canals and ditches.

There are several impacts that may be detrimental to the Topeka shiner and the headwater streams where it is found. This includes impoundments on the headwater streams. These impoundments may result in the introduction of predatory species such as the largemouth bass and they alter the hydrology of headwater pools that can fill in with gravel and leaves more rapidly. Other concerns include: channelization, sediment and agricultural activities such as grazing and fertilizing fields that can result in additional eutrophication in the areas waters (page 110 of the Topeka shiner section of the 1998 MTNF BA).

The surrounding private land consists mainly of agricultural land and scattered houses. The watershed has been impacted by the activities on private lands. Over 95% of the Middle River watershed occurs on non Forest Service System lands.

(Refer to pages 107 - 120 of the Topeka shiner section of the MTNF BA for additional information).

Survey Information:

Information from the Missouri Department of Conservation's Heritage Database was utilized in the preparation of this section.

There was one documented Topeka shiner sighting, approximately 1½ air miles north of the Project Area along Middle River in the early 1961. There have been no other documented Topeka Shiner sightings since then. (Page 108 MTNF BA). Additional surveys by the Missouri Department of Conservation in 1994 and 1995 of the same location (site 0869) did not find any Topeka shiners.

The Middle River project is located:

- Approximately 1 ½ air miles from the last Topeka Shiner sighting (1962) in the Middle River drainage.
- Approximately 5 air miles from Cedar Creek where the nearest recent Topeka shiner sighting occurred. Middle River does not drain into Cedar Creek or any Topeka shiner habitat.

Effects on the Topeka shiner

Direct and Indirect Effects: Because the Middle River Project Area does not contain or drain into any Topeka shiner habitat there would be no direct effect on any Topeka shiners. However, potential impacts to water quality will still be addressed.

Page 115 - 118 of the Topeka shiner section of the September 1998 Biological Assessment identifies numerous types of activities that may have a beneficial and/or adverse effect on the Topeka shiner (these are summarized on page 118). There are several categories of projects identified in Purpose and Need of the Middle River project that may have an Adverse Effect on the Topeka shiner. These include herbicide use (Page 117), Livestock grazing (Page 116), Timber harvest (Page 116, 117), Road Reconstruction (page 117) and Prescribed burning (Page 116).

1) Herbicide use: *Note: Some limited use of herbicide is planned. All application rates and methods would follow the manufacturers and EPA guidelines.*

Some limited application of Glyphosate (Roundup, Rodeo and Accord) would occur on the non-native Multi-flora Rose, which is a state listed noxious weed. Some limited application of Triclopyr (Garlon 3A and 4) would occur on approximately 60 acres to control *Serecia lespedeza*, which is a non-native invasive species.

In addition Glyphosphate would also be used to spot treat approximately 10 acres of old fescue fields. This would increase the hardwood seedlings survival in the thick fescue mat. All the applications would involve spot treatments only, there would be no aerial spraying.

Page 6 in the Introduction of the MTNF BA mentions the use of Glyphosate to help control noxious weeds. Glyphosate is a Foliar systemic herbicide (where the

herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms.

Glyphosphate would also be used to spot treat approximately 40 acres of Fescue (a non native invasive species) to increase the success of native hardwood plantings.

Triclopyr is a very species specific and effects the growth hormones and causes uncontrolled growth in plants. At sufficient levels, the abnormal growth is so severe that vital functions cannot be maintained and the plant dies.

According to page 4-1 of the Triclopyr Risk Assessment “At application rates that are equal to or greater then those contemplated by the Forest Service, these studies suggest that effect on animal populations will be secondary to changes in vegetation and food supply and that these will either have no effect or will be beneficial to birds as well as mammals.”

According to page 4-24 and 4-25 of the Triclopyr Risk Assessment “At plausible levels of acute exposure in standing water and streams, 0.07-0.5 mg/L, Garlon 3A is not likely to have any effect on fish and aquatic invertebrates, and most algae. Some sensitive macrophytes could be affected. Currently information is only available on the Eurasian watermilfoil. This species is adversely affected if water concentrations remain above 0.25 ml/L for more than 24 hours. Such concentrations are not plausible in streams but could be maintained in small standing bodies of water.” There would be no effect on invertebrate abundance. *Note: No application of Triclopyr would occur over live or standing water.*

Page 117 of the Topeka shiner section in the September 1998 Biological Assessment states that adverse impacts may occur if “use of fertilizers or pesticides inconsistent with approved labeling and application procedures...” *The herbicides to be used are registered with the EPA and would applied via approved application methods and only used as labeled.*

Page 13 of the BO states that on the Mark Twain National Forest “Herbicide use is restricted to noxious weed control, conversion of non-native fescue grass to native...”. Page 13, also states that “Glyphosate (Roundup, Rodeo, Accord) is used around buildings, for noxious weed control, ...”

Page 117 of the MTNF BA states “Aerial application is not permitted...” *No aerial application of herbicides would occur.*

Herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. No Topeka shiner, exist in the Middle River Project Area or the entire Middle River drainage. *Since the Middle River Project Area does not occur in or drain into any Topeka shiner habitat, there would be no effect on the Topeka shiner as a result of utilizing herbicides.*

2) Grazing: There would be approximately 440 acres of grazing in the Middle River Project Area. No grazing would occur in Riparian areas.

On the Mark Twain National Forest Grazing systems are designed to "... manipulate openland vegetation for the achievement of overall management area objectives. The range resource will be managed to the degree that it compliments, or does not detract from, other management area objectives". LRMP IV-24. These guidelines minimize the potential for excessive grazing (particularly in floodplains) which can be detrimental to this species.

Grazing would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *Since the Middle River Project Area does not occur in or drain into any Topeka shiner habitat, there would be no effect on the Topeka shiner as a result of utilizing grazing.*

3) Timber harvest and/or Tree removal: There would be approximately 450 acres of timber removal in the Middle River area. The harvest method is uneven-age management (group selections) *Note: None of these activities would occur in the Forested Riparian corridor along the Middle River.*

No timber harvest or tree removal would occur on approximately 200 acres that would be designated as Old Growth areas in the Middle River project. Timber harvest would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *Since the Middle River Project Area does not occur in or drain into any Topeka shiner habitat, there would be no effect on the Topeka shiner as a result of Timber harvest.*

4) Prescribed fire: Approximately 650 acres would be treated with prescribed fire to help maintain natural openings and enhance the ecosystem. The expected fire intensity is low. No dozer lines would be constructed in riparian areas or on steep slopes. In addition, burning has occurred in Missouri for centuries, this species has evolved with burning.

Prescribed fire would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *Since the Middle River Project Area does not occur in or drain into any Topeka shiner habitat, there would be no effect on the Topeka shiner as a result of Prescribed fire.*

5) Road maintenance/reconstruction: The maintenance of existing Forest Service system roads would occur. This would have a positive benefit for the areas watershed and fisheries as compared to no road maintenance. The existing unimproved live water crossing on Forest Road 1686 would be improved, so that sediment would no longer enter the stream after each vehicle crossing.

Road maintenance/reconstruction would have no additional effects beyond those previously disclosed and addressed in the Forest Plan BA. *Since the Middle River Project Area does not occur in or drain into any Topeka shiner habitat, there would be no effect on the Topeka shiner as a result of Road maintenance/reconstruction.*

ESA Cumulative Effects (50 CFR 402.02)

The cumulative effects spatial boundary for the Topeka shiner is the Middle River watershed. The cumulative effects temporal boundary of 10 years for the Topeka shiner was selected because all the items in the Middle River project would be implemented in the next 10 years. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

There are no direct, indirect effects on the Topeka shiner. In addition, the cumulative effects boundary for the Middle River Project Area does not occur in or drain into any Topeka shiner habitat. Therefore, there would be no cumulative effect on the Topeka shiner.

Findings of MTNF BA / BO compliance

Effects of project activities have been determined by this analysis to be the same or less than the effects described in the MTNF BA (pg. 107 – 120). *Note: This species was not addressed in the BO.* The MTNF BA project categories that may have a potential adverse effect are discussed in the Direct and Indirect effects section. In addition there are no activities proposed in the Middle River Project that were not identified and/or discussed in the MTNF BA.

Because all the proposed activities in Middle River are covered in the MTNF BA (page 107 - 120), there will be no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment.

Additional Resource Protection Measures

No new or additional Resource Protection Measures beyond the Forest Plan Standards and Guidelines (MTNF BA page 111 – 115) are required.

Conclusion/Determination:

The water quality in Middle River would be maintained and/or improved as a result of the following activities.

- 1). Improving the existing live water stream crossing (of a small tributary to Middle River) on Forest Road 1686 in order to reduce the amount of sediment entering the stream.
- 2.) Watershed and riparian area enhancements such as planting hardwoods (which would help to provide additional shade along the Middle River) would occur.

There are no Topeka shiners in the Middle River Project Area, in the Middle River watershed and the Middle River watershed does not drain into any Topeka shiner habitat. **Therefore there is a “No Effect” (NE) determination for the Topeka Shiner and the Middle River project.**

E. Running buffalo clover – *Trifolium stooniferum*

Species and habitat Information:

Running buffalo clover is a disturbance loving perennial plant that flowers in mid-April through June and fruits from May to July. Prior to 1994, the last sighting of the Running buffalo clover was in 1907 (page 55 MNTF BA)

The reasons for the plants decline in Missouri are unclear. “It may have depended on large herbivores (bison and elk) to periodically disturb areas and create habitat, as well as disperse seeds. As Bison and elk were eliminated, vital habitat and means of seed dispersal were lost page” (page 55 MTNF BA). “... a clover that was once widespread in the eastern half of the United States, which became nearly extinct, perhaps following the decimation of the North American Bison herds (*Trifolium stoloniferum*, running buffalo clover).” (Yatskievych 1999)

If there is not some type of disturbance, disturbance-dependant species will disappear due to a loss of habitat. (USDI – *Trifolium stoloniferum* Recovery Plan 1989)

“On the Mark Twain National Forest, the most probable limiting factors for Running buffalo clover are loss of open woodlands as forest have grown more dense in the past several decades, and loss of periodic fire” (page 56 MTNF BA).

(Refer to pages 55 - 63 of the Running buffalo clover section of the MTNF BA for additional information).

Survey Information:

Information from the Missouri Department of Conservations Heritage Database was utilized in the preparation of this section.

There are no documented sightings of any Running Buffalo Clover in the Middle River Project Area. There were several introductions in Callaway County in the early 1990’s of the Running buffalo clover approximately 5 air miles to the North. Many of these died from a virus infection (Hickey 1994). None of the surviving plants had any flowers in 1997 (Hickey 1997).

The Middle River project is located:

- Approximately 5 air miles from the nearest introduced Running buffalo clover plants.

Effects on the Running Buffalo Clover

Direct and Indirect Effects: The Middle River project does not contain any known Running buffalo clover plants. However, some of the activities proposed in Middle River may have an indirect effect this species by benefiting its habitat.

Page 60 – 61 of the Running buffalo clover section of the September 1998 Biological Assessment identifies numerous types of activities that may have a beneficial and/or adverse effect on the Running buffalo clover (these are summarized on page 61). The categories of projects identified in Purpose and Need of the Middle River project that may have an Effect on the Running buffalo clover is Herbicide use (Page 61), livestock grazing (Page 60) and prescribed fire (Page 60).

1) Herbicide use: *Note: Some limited use of herbicide is planned. All application rates and methods would follow the manufacturers and EPA guidelines.*

Some limited application of Glyphosate (Roundup, Rodeo and Accord) would occur on the non-native Multi-flora Rose, which is a state listed noxious weed. Some limited application of Triclopyr (Garlon 3A and 4) would occur on approximately 60 acres to control *Serecia lespedeza*, which is a non-native invasive species.

In addition Glyphosphate would also be used to spot treat approximately 10 acres of old fescue fields. This would increase the hardwood seedlings survival in the thick fescue mat. All the applications would involve spot treatments only, there would be no aerial spraying.

Glyphosphate would also be used to spot treat approximately 40 acres of Fescue (a non native invasive species) to increase the success of native hardwood plantings.

Triclopyr is a very species specific and effects the growth hormones and causes uncontrolled growth in plants. At sufficient levels, the abnormal growth is so severe that vital functions cannot be maintained and the plant dies.

According to page 4-1 of the Triclopyr Risk Assessment “At application rates that are equal to or greater than those contemplated by the Forest Service, these studies suggest that effect on animal populations will be secondary to changes in vegetation and food supply and that these will either have no effect or will be beneficial to birds as well as mammals.”

Page 6 in the Introduction of the MTNF BA mentions the use of Glyphosate to help control noxious weeds. Glyphosate is a Foliar systemic herbicide (where the herbicide is absorbed through the plants top growth only). It is then readily absorbed and translocated within the plant itself. Glyphosate is degraded into carbon dioxide by soil microorganisms.

Page 13 of the BO states that on the Mark Twain National Forest “Herbicide use is restricted to noxious weed control, conversion of non-native fescue grass to native...”. Page 13, also states that “Glyphosate (Roundup, Rodeo, Accord) is used around buildings, for noxious weed control, ...”

Page 61 of the MTNF BA states “Aerial application is not permitted...” and “The potential for herbicides to drift onto potential running buffalo clover sites is extremely low....” The nearest known location of Running buffalo clover plants (a introduced population) is approximately 5 air miles to the North.

Herbicide use would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *Because the distance to the nearest plants are over 5 air miles, there would be no direct effect on the Running buffalo clover itself as a result of utilizing herbicides. However, there would be the indirect effect of benefiting Running buffalo clover habitat by controlling invasive weeds.*

2) Grazing: There would be approximately 440 acres of grazing in the Middle River Project Area. No grazing would occur in Riparian areas.

On the Mark Twain National Forest Grazing systems are designed to “... manipulate openland vegetation for the achievement of overall management area objectives. The range resource will be managed to the degree that it compliments, or does not detract from, other management area objectives”. LRMP IV-24. These guidelines minimize the potential for excessive grazing which can be detrimental to this species.

Light and moderate livestock grazing can be beneficial to the Running Buffalo clover (Page 61 MTNF BA).

Grazing would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *There would be no direct effect on the Running buffalo clover itself as a result of utilizing grazing. However, there would be the indirect effect of benefiting potential Buffalo clover habitat.*

3) Prescribed fire: Approximately 650 acres would be treated with prescribed fire to help maintain natural openings and enhance the ecosystem. The expected fire intensity is low. No dozer lines would be constructed in riparian areas or on steep slopes. In addition, burning has occurred in Missouri for centuries, this species has evolved with burning. Prescribed burning would help to maintain the habitat conditions favorable for the Running buffalo clover.

Prescribed fire would have no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment. *There would be no direct effect on the Running buffalo clover as a result of Prescribed fire. However, there would be the indirect effect of benefiting Running buffalo clover habitat.*

ESA Cumulative Effects (50 CFR 402.02)

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

There are no direct, indirect effects on the Running buffalo clover. In addition the introduced plantings of Running buffalo clover do not occur within the above cumulative effects boundary. Therefore, there would be no cumulative effect on the Running buffalo clover.

Findings of MTNF BA compliance

Effects of project activities have been determined by this analysis to be the same or less than the effects described in the MTNF BA (pg. 55 – 63). *Note: The Running Buffalo clover was not covered in the June 1999 BO.* The MTNF BA project categories that may have a potential adverse effect are discussed in the Direct and Indirect effects section. In addition there are no activities proposed in the Middle River Project that were not identified and/or discussed in the MTNF BA. *See the Direct and Indirect section above for additional information.* **Because all the proposed activities in Middle River are covered in the BA (page 55 – 63), there will be no additional effects beyond those previously disclosed and addressed in the Forest Plan Biological Assessment.**

Additional Resource Protection Measures

No additional Resource Protection Measures are required beyond the Forest Plan standards and guidelines (MTNF BA page 57 – 59).

Conclusion/Determination:

“Management through prescribed fire, light grazing, control of exotic species and/or selective timber harvest may be used to improve the habitat conditions...” (Page 60, MTNF BA).

The potential habitat for the Running buffalo clover would be maintained and/or improved as a result of the following activities.

- (1) Open areas would be maintained utilizing several methods (including prescribed burning and/or grazing).
- (2) Un-even aged timber harvest would also open up some dense forest.
- (3) Exotic species would be controlled by mowing and/or the use of herbicides.

The Running buffalo clover is not known to occur in the Middle River area. However potential habitat would be maintained as a result of implementing the Middle River project. **Therefore there is a “No Effect” (NE) determination for the Running buffalo clover and the Middle River project.**

SIGNATURE

Klaus Leidenfrost
Houston/Rolla/Cedar Creek
District Wildlife Biologist

Date

REFERENCES AND DATA SOURCES

Missouri Department of Conservation, 1988. Species Management Plan for the Indiana Bat and Gray Bat in Missouri.

Missouri Department of Conservation. 2001. Survey for Endangered and other Unionid Species in the Upper Gasconade River Basin, Missouri.

Missouri Natural Heritage Database, 2001. Missouri species of conservation concern checklist. Missouri Department of Conservation. Jefferson City, Missouri. 28 pp.

Oesch, R.D. 1984. Missouri Naiades (A guide to the Mussels of Missouri) Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102. 270 p. (page 170-72).

Personnel communication with Sybill Amelon. Phone conversation between Klaus Leidenfrost and Sybill Amelon (U.S.F.S. North Central Research Station) on September 11, 2003 regarding the bat surveys in the Middle River Project Area in 2003.

Pflieger, W.L. 1997. The Fishes Of Missouri, Revised Edition. Mo Dept. Of Conservation. Jefferson City, Mo. 372 Pp.

Steyermark, J.L. 1963. Flora of Missouri. Iowa State University Press. Ames, Iowa. 1728 p.

USDA, Mark Twain National Forest Land & Resource Management Plan. 1986.

USDA Forest Service, Mark Twain National Forest, 1986. Wildlife Habitat Evaluation Handbook, Forest Service Handbook 2609.21.

USDA, Forest Service, 1998. Mark Twain National Forest Programmatic Biological Assessment, Eastern Region, Milwaukee, Wisconsin, September 1998.

USDA, Mark Twain National Forest Biological Evaluation (BE) program.

USDI, Fish and Wildlife Service, 1999. Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray Bat, Bald Eagle, Indiana Bat, and Mead's Milkweed on the Mark Twain National Forest, Missouri, Columbia, Missouri, June 23, 1999.

USDI, Fish and Wildlife Service, 1983. Recovery Plan for the Indiana bat. Washington, D.C. 80 pp.

USDI – Fish and Wildlife Service 1989. *Trifolium stoloniferum* Recovery Plan. U.S. Fish and Wildlife Service, Twin Cities, MN 26pp.

USDI, Fish and Wildlife Service . 1998. *Leptodea leptodon* (Scaleshell Mussel), Rangewide Status Assessment. Fort Snelling, MN.

USDI, Fish and Wildlife Service. 2001. Hines Emerald Dragonfly (*Somatochlora hineana*) Recovery Plan. Fort Snelling, MN. 120pg.

USDI, Fish and Wildlife Service Species list 07/31/02

Unpb Missouri Department Of Conservation Heritage Database. P.O. Box 180, Jefferson City, Missouri 65102. 573-751-4115.

Yatskievych, 1999. Steymark's – Flora of Missouri Volume 1 Revised Edition. Missouri Department of Conservation. Jefferson City, MO. 991pp.

Electronic Information sources:

The Nature Serve database <http://www.natureserve.org/explorer>.

Missouri Department of Conservation, Missouri Fish & Wildlife Information System, 2003. <http://www.conservaion.state.mo.us/nathiso/mofwis>

Missouri Department of Conservation, Missouri Natural Heritage Database. 2003. <http://www.conservaion.state.mo.us/cgi-bin/heritage/index.html>

USDA – Forest Service –Forest Health Protection – Pesticide Management & Coordination 2002. - Several pesticide risk assessments (including Glyphosate & Triclopyr) <http://www.fs.fed.us/foresthealth/pesticide/risk.htm>

**BIOLOGICAL EVALUATION FOR R-9 REGIONAL
FORESTER SENSITIVE SPECIES
IN THE MIDDLE RIVER PROJECT AREA
U.S.D.A. FOREST SERVICE
MARK TWAIN NATIONAL FOREST
HOUSTON/ROLLA/CEDAR CREEK RANGER DISTRICT
CALLAWAY COUNTY MISSOURI**

INTRODUCTION

The National Forest Management Act (NFMA) regulations of 36CFR 219.19 specify that fish and wildlife habitat will be managed to maintain viable populations of existing native and desired non-native species. This requirement is further developed in Chapter 2670 of the Forest Service Manual, which establishes a “Sensitive” category to include animal, plant, and fish species in addition to indicator species whose viability is a concern to the Forest Service. The objective is to ensure that these species do not become threatened and endangered because of Forest Service actions. The February 29, 2000, Forest Service R-9 Regional Forester Sensitive Species (RFSS) list is utilized. *Note: Additional information is contained in the Wildlife, Fisheries and Plant write-up in Chapter III of the Middle River Environmental Assessment.*

AREA AFFECTED

Project Location: The Middle River Project Area lies within the 43,374 acre Middle River (10300102240002) watershed. The Middle River Project Area contains 1,296 acres of Forest Service System lands. It is characterized by broad flat ridge tops, gently rolling topography and some steep bluffs overlooking Middle River itself. It predominately contains hardwoods and numerous openings.

The project is located in Township 46 North, Range 10 West sections 13, 15, 24, 25 and 36, Fifth Principle Meridian in Callaway County Missouri. It is located approximately 5 air miles Southwest of Fulton Missouri.

Management Areas: 3.4.

Project Area Size: 1,296 acres.

LTA's in Project Area: Middle River Breaks portion of the Oak Hickory Hills LTA (HO).

Latitude/Longitude: 38 degrees 45' 57" North and 92 degrees 00' 50" West.

U.S. Geological Survey Quadrangle (Topographic) Map(s): Fulton, Guthrie, Mokane West and New Bloomfield.

PROPOSED ACTION & ALL OTHER ALTERNATIVES

Note: All acreages are approximations.

Alternative 1 (No Action):

This alternative provides a baseline (reference point) against which to describe the environmental effects of the action alternatives. This is a viable alternative and responds to the concerns of those who want to keep the present openland management in place, but no additional activities would take place. The option for future management in this area would not be foreclosed.

The amount of existing openland (475 acres) would continue to exist in the area (which exceeds LRMP Desired Future Conditions objectives). Open land would not be planted to hardwood species and/or prescribed fire would continue to be utilized to keep areas in open/semi-open habitat.

If Alternative 1 is selected, current and on-going management activities would continue, but no new federal management activities would be initiated. However, no new old growth would be designated given that no project activities would be implemented. Changes, such as road maintenance, might occur through current management direction, natural processes, or other management decision in the future.

Alternative 2 (The Proposed Action):

This alternative includes the projects proposed through scoping. This alternative responds to the need to enhance wildlife habitats, improve watershed health and improve recreation. Below is a summary of actions that would occur in Alternative 2:

Enhance Wildlife Habitat

Maintain existing open/semi-open habitat on 400 acres through mowing, prescribed fire, and grazing

Designate an additional 107 acres for old growth wildlife species.

Create woodland habitat in oak, oak-pine and pine sawtimber with 20-30% forbs, grass, and shrub on 460 acres through uneven-age harvests; contribute to this habitat on 250 acres by prescribed burning.

Create 69 acres of 0-9 age class habitat through a portion of the preceding treatment.

Provide diverse amphibian habitat through breaching and lowering one pond.

Note: all or portions of some of the acres may be treated with fire more than once in the following decade.

Watershed Health Actions

Restrict livestock from wooded acres by fencing.

Reconstruct one pond and fence it to restrict cattle.

Reconstruct approximately .9 mile of Forest Road 1686 to improve drainage crossing.

Improve access in pastures with gravel
Close approximately .4 miles of non-system roads which exist in the project area.
Reduce soil movement in three wooded draws by planting native vegetation or installing watershed control structures.
Close 2 existing open wells
Plant hardwoods and restrict prescribed burning on 75 presently openland acres.
Maintain existing ponds

Recreation Management

Improve five parking lots with gravel
Construct interpretive cultural history signs.
Install self-closing gate to improve access for dispersed recreation.

Associated or Connected Action

Construct fire lines for prescribed burns.
Reduce non-native invasive and noxious weeds with herbicide spot treatment on 59 acres.
Reduce hardwood planting competition on 40 acres by spot treatment with herbicides to improve seedling survival.

Alternative 3 (The Preferred Alternative):

This alternative looks identical to alternative 2 in all aspects except some changes to several stands where individual and group harvests (uneven-age management) and connected actions would occur, reduces hardwood tree planting because an open field would be left open to grazing, and includes changes in stands proposed for old growth habitat.

Changes from Alternative 2 (the Proposed Action) include:

- Include 438 Acres proposed to maintain existing open/semi open habitat and native ecosystems (leaving existing openlands available for grazing open)
- Would include 37 acres of planting hardwoods and/or restricting prescribed burning (removal of one stand that would be left open for grazing)
- Would include some changes in stands proposed for old growth, but would keep total old growth to 189 acres.

Database, Reference Material and Survey information:

This section contains information that applies to all wildlife, fish and plant species and/or their habitat. In partnership with Mark Twain National Forest and others, the Missouri Department of Conservation has been very aggressive in conducting species surveys and maintaining data on both listed and common species.

Databases:

The Missouri Heritage Database not only includes specific locations of plant and animal species, but also includes occurrences of unique and/or rare natural communities. Many of these communities are suitable habitat for Federal Threatened and Endangered

Species (T&E), and/or Regional Forester's Sensitive Species (RFSS). The Missouri Department of Conservation Heritage Survey database is where all occurrences of terrestrial and non-terrestrial species in Missouri are officially documented.

The Missouri Department of Conservation maintains the Missouri Fish and Wildlife Information System (MOFWIS). MOFWIS contains information on over 700 species that are found in the State of Missouri. It includes information on numerous TE, RFSS, State of Missouri Endangered species, State of Missouri species of concern and other species. The information includes, but is not limited to a species documented sighting records, counties of occurrence, their life history, habitat requirements, effects (beneficial/adverse) from various activities and references.

The above two databases provide an excellent and up-to-date information source for numerous species. The Mark Twain National Forest contributes to and utilizes information from these database's. *Note: The two above sites can be accessed at www.conservation.state.mo.us/nathis/.*

Reference material:

Species' experts in Missouri have also been very aggressive in publishing excellent reference material that include specific species information such as their locations in the state and their habitat needs. The publications include: *Missouri Wildflowers*, *Missouri Orchids*, *Field Guide to Missouri Ferns*, *Walk Softly Upon the Earth (lichens and mosses)*, *Steiermark's Flora Of Missouri*, *Flora of Missouri, Volume 1*, *Butterflies and Moths of Missouri*, *The Crayfish of Missouri*, *The Fishes of Missouri*, *Naiades of Missouri*, *Birds of Missouri*, and *The Amphibians and Reptiles of Missouri*. These publications were utilized during the preparation of the following sections, including the evaluation of potential effects to the numerous species and/or their habitats in the Middle River Project Area.

The Mark Twain National Forest prepares the Wildlife, Fish, and Rare Plants (WFRP) Monitoring Report that includes information on trends of habitats, Management Indicator Species (MIS), and T&E species.

In March 2001 the Mark Twain National National Forest completed a Supplemental Information Report (SIR) to the LRMP on Salamanders. In June 2001 the Mark Twain Nation National Forest completed a SIR to the LRMP for the February 29, 2000 Regional Forester Sensitive Species list. Information from both of these SIR's was also utilized.

The Nature Conservancy maintains Element Stewardship Abstracts and Element Global Rankings that give specific information on species' locations, habitats, threats, propagation, life history, etc. These data sources were also consulted when analyzing potential effects of project implementation. The Nature Serve database can be accessed at www.natureserve.org.

Surveys:

Botanical surveys were conducted on the Houston/Rolla/Cedar Creek districts during the 1990's. Spring-fall Mist netting of bats were conducted on the Mark Twain National Forest in 1997, 1998, 1999, 2001 and 2002. Bat surveys were conducted in the summer of 2003 in the Middle River Project Area.

The Missouri Department of Conservation had two fish sample sites within several air miles of the Middle River Project area.

In addition to the extensive fieldwork done in preparation of the Missouri Heritage and MOFWIS databases and the publications, there are numerous field surveys conducted annually or as part of research projects in Missouri. The Mark Twain National Forest also has conducted surveys in partnership with others, or on its own. A sampling of these, include but are not limited to: Annual mid-winter eagle surveys, Forest bat surveys (cave, fall, summer, winter, mist-net, harp-trap, Anabat), Missouri Breeding Bird Atlas, Missouri Breeding Bird Survey Routes, Furbearer surveys, Cave Research Foundation Biological Inventories, Gardner and Gardner Cave Inventories, Botanical Surveys and Accipiter nest searches.

The information available on Threatened, Endangered, Proposed, and Sensitive (TES) Species locations and potential habitats in the Middle River Project Area is of sufficient quantity, quality, and relevance to make an accurate and complete analysis of potential effects on TES species in the Middle River Project Area. Enough information is available to make a reasoned management decision; therefore additional surveys are not needed for this project decision.

Sensitive Species Evaluated

Sensitive wildlife species that are documented to occur in the Middle River Project Area:

There are no documented RFSS species in the Middle River Project Area.

Sensitive wildlife species that have suitable habitat in the Middle River Breaks portion of Oak-Hickory Hills LTA and may occur in the Middle River Project Area:

Cerulean warbler (*Dendroica cerulea*): The Cerulean warbler is a Neotropical Migrant Bird. The Cerulean warbler is found in oak hickory forest in bottomlands and riparian areas. The nest is built 18-60 feet off the ground. The nesting season is between May and June. This species is usually found in large tracts of bottomland forest (usually 250+ Ha.). No large tracts of bottomland forest occur in the Middle River Project area or on the Cedar Creek portion of the Mark Twain National Forest.

Henslow sparrow (*Ammodramus henslowii*): The Henslow sparrow spend their entire life cycle within the Continental United States. This sparrow is often found in old fields or on prairies and is known to occur in Callaway County (the Middle River Project Area

is located within Callaway County). The loss of open prairie habitat is the main reason for this species declining numbers. Nest predation, usually from small mammals or snakes and to a smaller degree from Cowbirds is a concern (Herkert 2001). In Missouri this species may be found in lightly grazed or idle prairie pastures. Prairies burned in the spring may be utilized by July.

The breeding season for this ground nester is between late April and early September. The nests are usually built at the base of grass clumps and at least 50 meters from any wooded edges. The Henslow's sparrow usually raises 2 broods per year. For breeding it usually needs areas of suitable grassland habitat larger than 30 HA and it prefers warm season grasses over cool season grasses.

Direct and Indirect Effects:

Cerulean warbler

Alternative 1 (No Action):

There would be no change to the existing small amount of bottomland hardwood habitat. There would be no planting of hardwood trees in the bottomlands.

Items common to all action alternatives (Alternative 2 and 3):

The intensity of the prescribed fires is not enough to permanently alter any riparian bottomland hardwood habitat. These alternatives would plant hardwood trees on approximately 8 acres of bottomland hardwoods. No removal of forest products would occur in the bottomland hardwood habitat where this species may be found.

Henslow sparrow

Alternative 1 (No Action):

As a result of fire suppression, the existing amount of semi-open habitat would continue decline due to plant succession. Grazing which would help to maintain some of the areas openings would continue. No prescribed burning which would maintain some of the areas openings would occur.

Items common to all action alternatives (Alternative 2 and 3):

Grazing and/or prescribed burning which would help to maintain some of the areas openings would continue. While some timber harvest would occur in the area, it would not create or provide any suitable habitat for the Henslow's sparrow. *Note: None of the openings created by timber harvest are large enough to provide suitable habitat.*

Alternative 2:

Grazing and/or mowing and/or prescribed burning which would help to maintain some of the areas openings would continue, however at a reduced level. A total of 75 open acres would not be grazed or burned anymore in the future. This would allow these areas to naturally reforest themselves. Approximately 44 acres in the above openings would also be planted with hardwoods.

Alternative 3:

Grazing and/or mowing and/or prescribed burning which would help to maintain some of the areas openings would continue, however at a reduced level. A total of 37 open acres would not be grazed or burned anymore in the future. This would allow these areas to naturally reforest themselves. Approximately 8 acres (all in riparian areas) in the above openings would be planted with hardwoods.

Cumulative Effects

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Cerulean warbler

Some bottomland hardwood habitat would continue to be lost on non Forest Service system lands due to land clearing for agriculture and/or home sites. If a wildfire was to occur during time periods when a high intensity fire may occur, some riparian bottomland habitat could be temporarily altered. The species could be temporarily displaced and/or a nest could be inadvertently destroyed by a wildfire.

Henslows sparrow:

Activities such as fires suppression would continue, thereby resulting in a loss of potential habitat. In addition land conversion to home sites and other urbanization or be converted to row crops. Both of these activities would reduce the amount of potential habitat available. A wildfire could occur at any time, which could potentially displace some Migrant Loggerhead shrikes or destroy some potential nests. However a wildfire could help to maintain some of the larger openings required by this species.

Determinations:

Based on the above information, there is a determination of **“May Impact” (MI), but will not likely contribute to a trend towards federal listing or loss of Viability for all alternatives and the Henslow Sparrow.**

Based on the above information, there is a **“No Impact” (NI) determination for all alternatives and the Cerulean warbler.**

While the below species are not known to occur in the Middle River Project area or the Middle River Breaks portion of the Oak Hickory Hills LTA these sensitive species are found in the Oak Hickory Hills LTA and in prairies and are fire dependant species:

Yellow coneflower (*Echinacea paradoxa* var *paradxa*): This occurs in open areas such as glades, bald knobs or in prairies. It prefers openings larger than 1 acre in size. It also

likes areas with a 0-50% crown closure. This coneflower has been found near roadsides. This species is often found in areas that are maintained by fire.

Wavy Leaf purple coneflower (*Echinacea simulata*): This coneflower occurs in openings such as glades, savannas and on prairies. This species is often found in area's that are maintained by fire.

Royal Catchfly (*Silene Regina*): This species likes open areas such as glades, bald knobs, savannas and rocky prairies with a canopy closure between 0 and 55 percent. It has also been observed along old logging roads. This species is often found in areas that are maintained by fire.

Direct and Indirect Effects

Yellow coneflower:

Alternative 1: No Action

Because this is a fire dependant species, if no prescribed fires were to occur in the area, the amount of potential Yellow coneflower habitat would continue to be reduced and maybe even be lost eventually due to plant succession.

Items common to all action alternatives (Alternative 2 and 3):

These alternatives would burn the area where Yellow coneflower habitat may potentially be found. Prescribed burning would benefit potential habitat by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres.

Alternative 3:

This alternative burns a total of 688 acres, of which 438 consist of openland acres.

Wavy leaf purple coneflower:

Alternative 1: No Action

There is no existing Wavy leaf purple coneflower habitat in the Middle River area. Because this is a fire dependant species, if no prescribed fires were to occur in the area, the amount of potential Wavy leaf purple coneflower habitat would continue to be reduced and maybe even be lost eventually due to plant succession.

Items common to all action alternatives (Alternative 2 and 3):

These alternatives would burn the area where Wavy leaf purple coneflower habitat would potentially be found. Prescribed burning would benefit potential habitat by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres. .
This burning would help the habitat for this fire dependant species.

Alternative 3:

This alternative burns a total of 688 acres, of which 438 consist of openland acres. .
This burning would help the habitat for this fire dependant species.

Royal Catchfly:**Alternative 1: No Action**

Because this is a fire dependant species, if no prescribed fires and/or wildfires were to occur in the area, the potential Royal catchfly habitat would continue to be reduced and may even eventually be lost due to plant succession.

Items common to all action alternatives (Alternative 2 and 3):

Prescribed fire would help to enhance and/or maintain any potential Royal Catchfly habitat, by eliminating and/or reducing woody encroachment into previously open areas. The effect of the burns enhancement in these areas would last for approximately 3 years. Any burns after that period would help to maintain the existing habitat.

Alternative 2:

This alternative burns a total of 650 acres, of which 400 consist of openland acres.

Alternative 3:

This alternative burns a total of 688 acres, of which 438 consist of openland acres.

Cumulative Effects

The cumulative effects spatial boundary of the Middle River Breaks portion of the Oak Hickory Hills LTA is being utilized. The cumulative effects temporal boundary of 10 years was selected because that is the life of the Middle River project. These boundaries were selected so that the cumulative effects information would be measurable and meaningful.

Yellow coneflower and Wavy leaf purple coneflower:

Timber harvest has resulted in a short-term increase of their habitats. Conversely fire suppression has resulted in a decline of their habitats. Land clearing for agriculture and/or home sites on non Forest Service system lands has resulted in a change (positive and negative) to their habitat. Areas that are converted to row crops and/or lawns do not provide suitable habitat for this species. A wildfire could occur during time periods when a high fire intensity may occur. A hot wildfire could potentially enhance or create some habitat for these fire dependant species.

Royal Catchfly:

Timber harvest has resulted in an increase of their habitats. Conversely fire suppression has resulted in a decline of their habitats. Land clearing for agriculture and/or home sites on non Forest Service system lands has resulted in a change (positive and negative) to their habitat. Areas that are converted to row crops and/or lawns do not provide suitable habitat for this species. A wildfire could occur during time periods when a intense fire may occur. A hot wildfire could open up more areas and thereby create more potential Royal catchfly habitat then a low intensity prescribed fire(s) could.

Determinations:

Based on the above information and that there is no known existing habitat for these species, there is a **“No Impact” (NI) determination for all alternatives and the Yellow coneflower, Wavy Leaf purple coneflower and Royal Catchfly.**

Sensitive species which are not likely to occur in the Middle River Project area (including the Middle River Break portion of the Oak-Hickory Hills LTA) due to a lack of suitable habitat:

This includes the Migrant Loggerhead shrike, Bachman's sparrow, Central Missouri cave amphipod, Eastern small spotted bat, Spectacle case naiad, Ouachita kidneyshell, Onondaga cave amphipod, Peregrine falcon, Bluff vertigo snail, Eastern Hellbender, Ozark Hellbender, Alligator Snapping turtle, Tumbling Creek cavesnail, Western fanshell, Snuffbox, Southern hickorynut, Sheepnose, Rabbitsfoot, Purple lilliput, Greer Springs micro-caddisfly, A Springtail (*Pseudosinella espana*), Dimorphic isopod, Bristly cave crayfish, Coldwater crayfish, Big River crayfish, Meek's crayfish, Big Creek crayfish, St. Francis River crayfish, White River crayfish, Western sand darter, Brook darter, Current darter, Ozark shiner, Sabine shiner, Longnose darter, Stargazing darter, Eastern slim minnow, Southern cavefish, Ozark sculpin, Blacknose shiner, Bluestripe darter, Crystal darter, Purple false foxglove, Earleaf foxglove, Wood Anemone, Tradescantia aster, Forked aster, Large-leaf aster, American barberry, Ofer hollow reedgrass, Bush's poppy mallow, Marsh bellflower, Buxbaum's sedge, Cherokee sedge, Fibrous-root sedge, Epiphytic sedge, Large sedge, Oklahoma sedge, Sharp-scale sedge, Dioecious sedge, Tussock sedge, Rigid sedge, Fox sedge, Ozark chinkapin, Southern cayaponia, Southern cayaponia, Ivy treebine, Trelease's larkspur, Yادkinense panicgrass, Open-ground whitlow-grass, Small flower throughwort, Pale avens (*Geum virginianum*), Featherfoil, Whorled pennywort, Large whorled pogonia, Weak rush, Small-fruit seedbox, Baldwin's milkvine, Bog buckbean, Large-leaf grass-of-parnassus, Carolina phlox, Spotted phlox, Knotweed leaf-flower, Yellow-fringed Orchid, Small green woodland orchid, Southern rein orchid (*Platanthera flava flava*), Pale green orchid, Halberd-leaf tearthumb, Spotted pondweed, Nuttall's oak, Harvey's beakrush, Orange (Sullivant) coneflower, Narrow-leaf pink, Gibbous panic-grass, Canby's bulrush, Weakstalk bulrush, Hall's bulrush, Kidney-leaved sullivantia, Ozark spiderwort, Ozark trillium, Yellowleaf tinker's weed, Ozark cornsalad, Northern arrow-wood, Barren strawberry, A liverwort (*Metzgeria furcata*), Yellow starry fen moss, A moss (*Dichelyma capillaceum*), A moss (*Seligeria donniana*), Narrowleaf peatmoss, Sphagnum moss, Log

fern (*Dryopteris celsa*), Goldies woodfern, Netted chain fern, Butternut, Oval Ladies' Tresses, Fissa sedge, Straw sedge, Bush's skullcap, Gattinger goldenrod, Pale Manna grass and Sand grape. *Note: Because these Sensitive species and their habitat does not occur in the Middle River Project Area including the Middle River Breaks portion of the Oak-Hickory Hills LTA they will not be discussed any further in this document.*
Therefore a "No Impact" (NI) is concluded for all the above listed species.

Irreversible or Irretrievable Commitment on Resources

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed Middle River Project Area.

References:

- Bruendermann, S.A, J.S. Faiman, A.C. Buchman. 2001, Survey for Endangered and Other Unionid Species in the Upper Gasconade River Basin, Missouri. Missouri Department of Conservation, 1000 South College Ave. Columbia, MO 65201 97 pp.
- Herkert, J.R. 2001. Effects of management activities on grassland birds: Henslow's Sparrow. North Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND. 17 pages.
- Oesch, R.D. 1984. Missouri naiades: a guide to the mussels of Missouri. Jefferson City: Conservation Commission of the State of Missouri. 270pp.
- Partners in Flight. 2000. Bird Conservation Plan for the Prairie Peninsula (Physiographic Area 31). 52 pages.
- Pflieger, W.L. 1997. The Fishes Of Missouri, Revised Edition. Mo Dept. Of Conservation. Jefferson City, Mo. 372 Pp.
- Steyermark, J.L. 1963. Flora of Missouri. Iowa State University Press. Ames, Iowa. 1728 p.
- U.S.D.A. Forest Service, Mark Twain National Forest, 1986. Wildlife Habitat Evaluation Handbook, Forest Service Handbook 2609.21.
- U.S.D.A., Mark Twain National Forest Land & Resource Management Plan. 1986.
- U.S.D.A., Forest Service, 1998. Mark Twain National Forest Programmatic Biological Assessment, Eastern Region, Milwaukee, Wisconsin, September 1998.
- U.S.D.A Forest Service –Forest Health Protection – Pesticide Management & Coordination 2002. - Several pesticide risk assessments (including Glyphosate).

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Supplemental Information Report, 2000 RFSS List.

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Supplemental Information Report, Salamanders.

U.S.D.A., Forest Service. 2001. Mark Twain National Forest, Final_Monitoring_Report_DFC_MIS_TEP_RFSS_OCTOBER_2001. Rolla, MO 65401. 8 pg.

U.S.D.A Mark Twain National Forest Biological Evaluation (BE) program.

Unpb Missouri Department Of Conservation Heritage Database. P.O. Box 180, Jefferson City, Missouri 65102. 573-751-4115.

Yatskievych, G. 1999. Steyermark'S Flora Of Missouri, Volume I (Revised Edition). Missouri Dept. Of Conservation And Missouri Botanical Garden Press. St Louis, Mo. 991 Pp.

Electronic Information sources:

The Missouri Department of Conservation maintains the Missouri Fish and Wildlife Information System (MOFWIS) and Heritage database. *Note: The two above sites can be accessed at www.conservation.state.mo.us/nathis/.*

The Nature Serve database <http://www.natureserve.org/explorer> was accessed on June 30, 2003.

U.S.D.A. – Forest Service –Forest Health Protection – Pesticide Management & Coordination 2002. - Several pesticide risk assessments (including Glyophaste). <http://www.fs.fed.us/foresthealth/pesticide/risk.htm>

**MARK TWAIN NATIONAL FOREST BIOLOGICAL EVALUATION AND SUMMARY OF EFFECTS
FOREST SERVICE (R-9) REGIONAL FORESTER SENSITIVE SPECIES (2/29/2000 list)**

Project Name: Middle River **Project Location:** Houston/Rolla/Cedar Creek Ranger District **LTA:** HO

Contact Name: Klaus Leidenfrost

Project location legal description: Township 46 North, Range 10W, sections 13, 14, 24, 25 and 36.

Project Type and Information: The Middle River project includes various Wildlife Habitat enhancement needs (via open land management, prescribed fire and timber harvest), Watershed health needs, Recreation Management needs and any connected and associated Actions. (See Chapter 1 and 2 of the Middle River Environmental Assessment for additional information).

Only the Henslow's sparrow, Cerulean warbler, Yellow coneflower, Wavy-leaf Purple coneflower and the Royal catchfly were fully analyzed for this project. See the Wildlife, Fish and Plant Sensitive species sections in Chapter 3 of the Middle River Environmental Assessment for the actual analysis (including any effects) on these species.

Note: A NI determination is concluded for all the other RFSS not listed below since they do not occur in or have habitat within the Middle River Project Area or the Middle River Breaks portion of the Oak Hickory Hills LTA.

Common Name	Scientific Name	Status	Species Present	Habitat Present	Species Potentially Affected?	Habitat Potentially Affected?	Determinations		
							Alt.1	Alt.2	Alt. 3
Henslow's sparrow *	<i>Ammadramus henslowii</i>	S	N	Y	Y	Y	MI	MI	MI
Cerulean warbler *	<i>Dendroica cerulea</i>	S	N	Y	N	N	NI	NI	NI
Yellow coneflower **	<i>Echinacea paradoxa var paradoxa</i>	S	N	N	N	Y	NI	NI	NI
Wavy-leaf Purple coneflower **	<i>Echinacea simulata</i>	S	N	N	N	Y	NI	NI	NI
Royal catchfly **	<i>Silene regia</i>	S	N	N	N	Y	NI	NI	NI

* Occurs in the Middle River Breaks portion of the Oak Hickory Hills LTA.

** Does not occur in the Middle River Breaks portion of the Oak Hickory Hills LTA. However they do occur in other portions of the Oak Hickory Hills LTA. These species require openings such as prairies and they are fire dependant species, therefore they were included in this analysis.

Status T = Threatened, E = Endangered, P = Proposed, S = Forest Service Region 9 Sensitive Species.

Determination for Federally listed Species: NE – No Effect, NLAA – Not Likely to Adversely Effect, NLAA (BE) - Not Likely to Adversely Effect with a Beneficial Effect, LAA - Likely to adversely Effect, NLJCE- Not Likely to Jeopardize the continued existence (proposed species only) BA/BO – Tiered to Biological Assessment/Biological Opinion.

Determination for Forest Service Sensitive Species: NI – No Impact. MI – May impact, but will not likely contribute to a trend towards federal listing or loss of Viability. WI- Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability.

SIGNATURE

Klaus Leidenfrost
Klaus Leidenfrost
Houston/Rolla/Cedar Creek
District Wildlife Biologist

Sept. 15, 2003
Date

APPENDIX H

Photographs of Invasive Plants in Project Area, Herbicide Labels, Material Safety Data Sheets,

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Photographs of Invasive Plants Sites in Middle River Project Area



Figure 1: Multiflora Rose plant



Figure 2: Serecia Lespedeza plants in Stand 56, Compartment 9



Figure 3: Hardwood Tree Planting Site, Stand 8, Compartment 9

Herbicide Labels and MSDS for glyphosate products Roundup and Rodeo are available online at:
<http://www.fs.fed.us/foresthealth/pesticide/material.htm>

Herbicide Labels and MSDS for triclopyr products Garlon 3A and Garlon 4 are available at
<http://www.dowagro.com>